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(54)【発明の名称】　燃料流体の流れを再循環させるための調節された真空イジェクターを具備した電気化学的燃料電池装置

(57)【要約】
発電装置は、流体燃料の流れを再循環させるための調節された真空イジェクターを有する。該装置は、燃料電池スタック（１００）と、燃料供給圧を調節するための圧力制御弁（１２２）を有する加圧された燃料供給部（１２０）と、燃料供給部（１２０）とスタックの燃料流の入口（１１０）との間に挿入された真空イジェクター（１２４）と、イジェクターの排出口（１３０）とスタックの燃料流の入口（１１０）との間に挿入された圧力変換器（１３２）と、圧力変換器（１５６）を具備した加圧された酸化剤供給部（１５０）とを含む。イジェクターの吸入口（１２８）は、燃料電池スタックの燃料流の出口（１１２）と流体が通るように接続されている。燃料流の圧力変換器は、燃料流の検出圧が所定の値から外れた時に信号を圧力制御弁へ伝送して燃料供給圧を調整する。酸化剤流の圧力変換器は、酸化剤流の検出圧が変化した時に信号を圧力制御弁へ伝送して燃料供給圧を調整する。この装置は、負荷追従性を示し、燃料流の圧力及び再循環比を、広範囲の運転条件にわたり一定に維持する。この装置はまた、燃料流の圧力と酸化剤流の圧

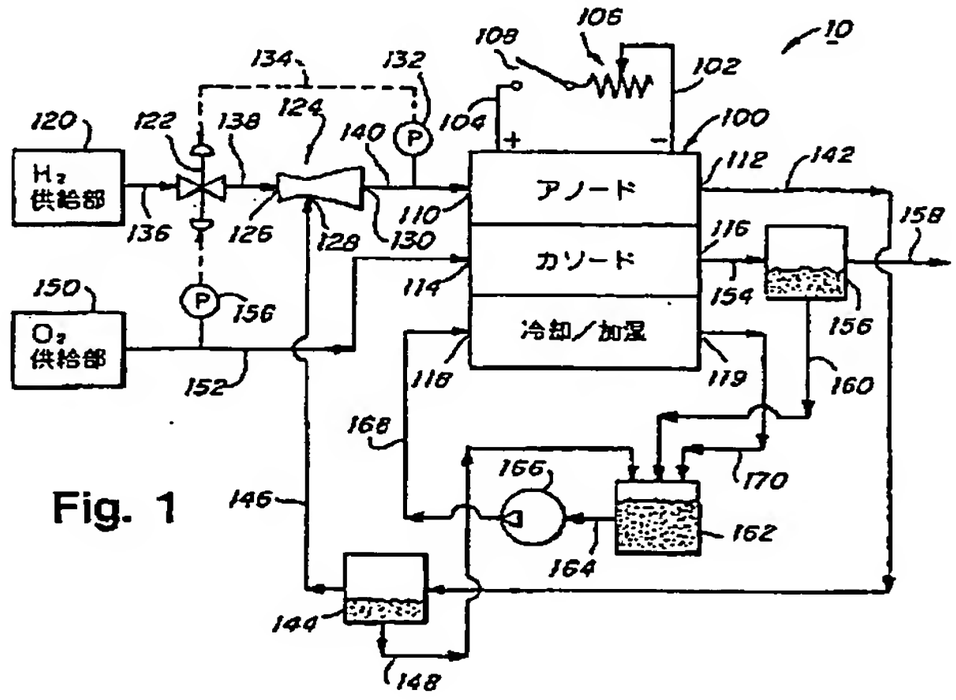

Fig. 1

【特許請求の範囲】

１．（ａ）燃料流の入口と、燃料流の出口と、酸化剤流の入口と、前記燃料流の入口で導入された燃料流と前記酸化剤流の入口で導入された酸化剤流との電気触媒反応を促進して電気、反応生成物及び熱を得るための少なくとも一つの燃料電池とを含んで成る燃料電池スタック；

（ｂ）燃料供給圧を調節するための圧力制御弁を有する加圧された燃料供給部；

（ｃ）前記燃料供給部と前記燃料流の入口との間に挿入された真空イジェクターであって、推進用入口と、吸入口と、排出口とを含み、前記推進用入口と前記燃料供給部とは流体が通るように接続されており、前記吸入口と前記燃料流の出口とは流体が通るように接続されており、そして前記排出口と前記燃料流の入口とは流体が通るように接続されている真空イジェクター；

（ｄ）前記燃料流において前記排出口と前記吸入口との間に挿入された圧力変換器であって、前記燃料流の圧力を検出して対応する信号を前記圧力制御弁へ伝送する圧力変換器；及び

（ｅ）前記酸化剤流の入口と流体が通るように接続されている加圧された酸化剤供給部

を含んで成る発電装置であって、

前記圧力変換器は、前記燃料流の検出圧が所定の値を下回った時には信号を前記圧力制御弁に伝送して前記燃料供給圧を上昇させ、且つ、前記圧力変換器は、前記燃料流の検出圧が所定の値を上回った時には信号を前記圧力制御弁に伝送して前記燃料供給圧を低下させる発電装置。

２．前記燃料電池スタックがさらに酸化剤流の出口を含む、請求

項１に記載の発電装置。

３．前記圧力変換器が、前記燃料流において、前記排出口と前記燃料流の入口との間に挿入されている、請求項１に記載の発電装置。

４．前記圧力変換器が、前記燃料流の検出圧に相当する電気信号を前記圧力制御弁へ伝送する、請求項１に記載の発電装置。

５．前記圧力変換器が、前記燃料流の検出圧に相当する液圧信号を前記圧力制御弁へ伝送する、請求項１に記載の発電装置。

６．前記圧力変換器が、前記燃料流の検出圧に相当する空気圧信号を前記圧力制御弁へ伝送する、請求項１に記載の発電装置。

７．前記加圧された燃料供給部が実質的に純粋な水素を含む、請求項１に記載の発電装置。

８．前記加圧された酸化剤供給部が酸素を含み且つ前記反応生成物が水である、請求項７に記載の発電装置。

９．前記酸化剤供給部が含酸素空気である、請求項８に記載の発電装置。

１０．前記燃料電池の少なくとも一つがイオン交換膜を含み、そして前記装置はさらに、前記燃料流に水蒸気を付与するための燃料流加湿器及び前記酸化剤流に水蒸気を付与するための酸化剤流加湿器を含む、請求項１に記載の発電装置。

１１．前記燃料流の出口と前記吸入口との間に水分離器を挿入し、よって前記燃料流中に含まれる水分の少なくとも一部を除去する、請求項１０に記載の発電装置。

１２．前記酸化剤供給部が、前記酸化剤流の圧力を検出して対応する信号を前記圧力制御弁へ伝送するための圧力変換器を有し、よって前記酸化剤流の検出圧が上昇した時には前記酸化剤流の圧力変換器が信号を前記圧力制御弁に伝送して前記燃料供給圧を上昇させ、且つ、前記酸化剤流の検出圧が低下した時には前記酸化剤流の圧力

変換器が信号を前記圧力制御弁に伝送して前記燃料供給圧を低下させる、請求項１に記載の発電装置。

１３．（ａ）燃料流の入口と、酸化剤流の入口と、酸化剤流の出口と、前記燃料流の入口で導入された燃料流と前記酸化剤流の入口で導入された酸化剤流との電気触媒反応を促進して電気、反応生成物及び熱を得るための少なくとも一つの燃料電池とを含んで成る燃料電池スタック；

（ｂ）酸化剤供給圧を調節するための圧力制御弁を有する加圧された酸化剤供給部；

（ｃ）前記酸化剤供給部と前記酸化剤流の入口との間に挿入された真空イジェクターであって、推進用入口と、吸入口と、排出口とを含み、前記推進用入口と前記酸化剤供給部とは流体が通るように接続されており、前記吸入口と前記酸化剤流の出口とは流体が通るように接続されており、そして前記排出口と前記酸化剤流の入口とは流体が通るように接続されている真空イジェクター；

（ｄ）前記酸化剤流において前記排出口と前記吸入口との間に挿入された圧力変換器であって、前記酸化剤流の圧力を検出して対応する信号を前記圧力制御弁へ伝送する圧力変換器；及び

（ｅ）前記燃料流の入口と流体が通るように接続されている加圧された燃料供給部

を含んで成る発電装置であって、

前記圧力変換器は、前記酸化剤流の検出圧が所定の値を下回った時には信号を前記圧力制御弁に伝送して前記酸化剤供給圧を上昇させ、且つ、前記圧力変換器は、前記酸化剤流の検出圧が所定の値を上回った時には信号を前記圧力制御弁に伝送して前記酸化剤供給圧を低下させる発電装置。

１４．前記燃料電池スタックがさらに燃料流の出口を含む、請求

項１３に記載の発電装置。

１５．前記圧力変換器が、前記酸化剤流において、前記排出口と前記酸化剤流の入口との間に挿入されている、請求項１３に記載の発電装置。

１６．前記圧力変換器が、前記酸化剤流の検出圧に相当する電気信号を前記圧力制御弁へ伝送する、請求項１３に記載の発電装置。

１７．前記圧力変換器が、前記酸化剤流の検出圧に相当する液圧信号を前記圧力制御弁へ伝送する、請求項１３に記載の発電装置。

１８．前記圧力変換器が、前記酸化剤流の検出圧に相当する空気圧信号を前記圧力制御弁へ伝送する、請求項１３に記載の発電装置。

１９．前記加圧された酸化剤供給部が実質的に純粋な酸素を含む、請求項１３に記載の発電装置。

２０．前記加圧された燃料供給部が水素を含み且つ前記反応生成物が水である

、請求項１９に記載の発電装置。

２１．前記燃料電池の少なくとも一つがイオン交換膜を含み、そして前記装置はさらに、前記燃料流に水蒸気を付与するための燃料流加湿器及び前記酸化剤流に水蒸気を付与するための酸化剤流加湿器を含む、請求項１３に記載の発電装置。

２２．前記酸化剤流の出口と前記吸入口との間に水分離器を挿入し、よって前記酸化剤流中に含まれる水分の少なくとも一部を除去する、請求項２１に記載の発電装置。

２３．前記燃料供給部が、前記燃料流の圧力を検出して対応する信号を前記圧力制御弁へ伝送するための圧力変換器を有し、よって前記燃料流の検出圧が上昇した時には前記燃料流の圧力変換器が信号を前記圧力制御弁に伝送して前記酸化剤供給圧を上昇させ、且つ、前記燃料流の検出圧が低下した時には前記燃料流の圧力変換器が信号を前記圧力制御弁に伝送して前記酸化剤供給圧を低下させる、請

求項１３に記載の発電装置。

２４．第一反応体流の入口と、第一反応体流の出口と、第二反応体流の入口と、前記第一反応体流の入口で導入された前記第一反応体流と前記第二反応体流の入口で導入された前記第二反応体流との電気触媒反応を促進して電気、反応生成物及び熱を得るための少なくとも一つの燃料電池とを含む燃料電池スタックを含んで成り、さらに、加圧された第一反応体供給部であって、前記第一反応体供給部の圧力を調節するための圧力制御弁を有するものと、加圧された第二反応体供給部とを含んで成る発電装置において、第一反応体流を再循環させる方法であって、

（ａ）推進用入口と、吸入口と、排出口とを含む真空イジェクターを、前記第一反応体供給部と前記第一反応体流の入口との間に挿入する工程；

（ｂ）前記推進用入口を前記第一反応体供給部と流体が通るように接続する工程；

（ｃ）前記吸入口を前記第一反応体流の出口と流体が通るように接続する工程

；

（ｄ）前記排出口を前記第一反応体流の入口と流体が通るように接続する工程

；

（ｅ）前記第一反応体流の圧力を検出して対応する信号を前記圧力制御弁に伝送することができる圧力変換器を、前記排出口と前記吸入口との間に挿入する工程；

（ｆ）前記第一反応体流の検出圧が所定の値を下回った時に、信号を前記圧力制御弁に伝送して前記第一反応体の供給圧を上昇させる工程；及び

（ｇ）前記第一反応体流の検出圧が所定の値を上回った時に、信号を前記圧力制御弁に伝送して前記第一反応体の供給圧を低下させ

る工程

を含む前記方法。

２５．前記第一反応体流が水素を含み、且つ、前記第二反応体流が酸素を含む、請求項２４に記載の方法。

２６．（ｈ）前記第二反応体流の圧力を検出して対応する信号を前記圧力制御弁に伝送することができる第二反応体圧力変換器を、前記第二反応体流の入口と前記第二反応体供給部との間に挿入する工程；

（ｉ）前記第二反応体流の検出圧が上昇した時に、信号を前記圧力制御弁に伝送して前記第一反応体の供給圧を上昇させる工程；及び

（ｊ）前記第二反応体流の検出圧が低下した時に、信号を前記圧力制御弁に伝送して前記第一反応体の供給圧を低下させる工程

をさらに含む、請求項２４に記載の方法。

【発明の詳細な説明】

燃料流体の流れを再循環させるための調節された真空イジェクターを具備した電気化学的燃料電池装置

発明の分野

本発明は電気化学的燃料電池に関する。より詳細には、本発明は、燃料電池スタックと、燃料流体の流れを再循環させるための調節された真空イジェクターとを含む電力発生装置に関する。この装置は、燃料の再循環比率を一定に維持し、燃料流圧と酸化剤流圧との間のバランスを維持する。

発明の背景

電気化学的燃料電池は燃料と酸化剤を電気と反応生成物に変換する。固体ポリマー電気化学的燃料電池は、イオン交換膜又は固体ポリマー電解質が多孔質導電性シート材料（典型的には炭素繊維紙）でできた２枚の電極間に配置されて成る膜電極集成体「ＭＥＡ」を使用するのが一般的である。ＭＥＡは、所望の電気化学反応を誘発させるため、膜／電極の各界面に、典型的には微粉状白金である触媒層を含有する。これらの電極は電気的に接続されており、電極間の電子を外部負荷へと導くための通路が提供される。

アノードでは、燃料が多孔質電極材料を透過し触媒層で反応することでカチオンが生成し、これが膜を通してカソードまで移動する。カソードでは、供給された含酸素ガスが触媒層で反応してアニオンが生成する。このカソードで生成したアニオンがカチオンと反応して反応生成物が得られる。

燃料として水素を、酸化剤として含酸素空気（又は実質的に純粋な酸素）を使用する電気化学的燃料電池の場合、アノードでは触媒反応により供給燃料から水素カチオン（プロトン）が生成する。イオン交換膜により、アノードからカソードへの水素イオンの移動が促進される。水素イオンの導通の他、該膜は含水素燃料の流れと含酸素燃料の流れとを分離する。カソードでは、酸素が触媒層で反応してアニオンが生成する。カソードで生成したアニオンは、該膜を横断してきた水素イオンと反応し、その反応生成物として液状の水が生成する。水素／酸素系の燃料電池におけるアノード及びカソードの反応は以下の通りであ

る。

アノード反応：$H_2 \rightarrow 2H^+ + 2e^-$

カソード反応：$1/2\ O_2 + 2H^+ + 2e^- \rightarrow H_2O$

典型的な燃料電池では、それぞれ少なくとも１本の流路が内部に刻み込まれている２枚の導電板の間にＭＥＡが配置されている。これらの流体が流れる場となる導電板は、グラファイトでできている場合が典型的である。これらの流路により燃料と酸化剤がそれぞれの電極、すなわち、燃料側ではアノードに、そして酸化剤側ではカソードに方向付けられる。単一電池式の場合、流体が流れる場となる導電板がアノード側、カソード側のそれぞれに設けられている。この流体が流れる場となる導電板は、集電体として作用し、電極のための支持体となり、燃料及び酸化剤をそれぞれアノード及びカソードの表面へ導くアクセス流路となり、そして電池運転中に生成する水を除去するための流路になる。

二以上の燃料電池を、一般には直列に、場合によっては並列に、互いに接続し合い、集成体の全体出力を増大させることができる。直列配置の場合、流体が流れる場となるある導電板の片側はある電池ではアノード板として作用し、その流体が流れる場となる導電板の反対側は隣接する電池のカソード板として作用し得る。このよう

な直列に接続された複数の燃料電池の配置を燃料電池スタックと称し、通常は集成された状態でタイ・ロッド及び端板によって一緒に保持されている。スタックは、燃料流体の流れ（実質的に純粋な水素、メタノール改質物又は天然ガス改質物）及び燃料酸化剤の流れ（実質的に純粋な酸素又は含酸素空気）をアノード及びカソードの流れの場となる流路へ方向付けるためのマニホールド及び入口を含むことが典型的である。スタックはまた、燃料電池内部の水素と酸素の発熱反応により発生する熱を吸収するため、スタック内部の内部流路に冷媒流体（典型的には水）の流れを方向付けるためのマニホールド及び入口を含むことが普通である。さらにスタックは、それぞれ水の連行を伴う未反応燃料及び酸化剤ガスを追い出すための排出マニホールド及び出口、並びにスタックから出てくる冷媒のための排出マニホールド及び出口を含むことが一般的である。

一般に、固体ポリマー燃料電池は、ペルフルオロスルホン酸系イオン交換膜、例えば、DuPont社よりNAFIONの商品名で市販されているものや、Dow 社よりXUS 13204.10の商品名で市販されているものを使用する。このような膜を使用する場合、燃料及び酸化剤の反応体の流れをそれぞれ加湿してから固体ポリマー燃料電池へ導入することにより、カチオン交換を促進すると共に、各電池のアノードとカソードを分離しているイオン交換膜の乾燥、ひいては損傷を防止することが一般的である。

スタックを構成している各燃料電池には、特定の燃料及び酸化剤が所望の圧力で多量に流されることが典型的である。この圧力は、一般には反応体の出所において調節器で制御される。電極を接続している回路に電気的負荷がかけられると、その負荷により引き出される電流に直接比例して燃料と酸化剤が消費される。

燃料電池スタックから出てくる各反応体の流れは、一般に水を含有する。アノード由来の出口燃料流は、カソードから膜を横断して引き出されて燃料流中に蒸気として吸収されたすべての生成物の水と燃料流を加湿するために加えられた水とを含有することが一般的である。カソード由来の出口酸化剤流は、水滴として連行されるか又は酸化剤流中に蒸気として吸収されるカソードで生成した生成物の水と酸化剤流を加湿するために加えられた水とを含有することが一般的である。燃料電池スタックの出力の増大と共に、アノード及びカソードに蓄積する水分が増加するので、水を除去してスタック内の流路が塞がれないよう維持するため、再循環流速を高くしなければならない。

燃料電池から出てくる反応体流の一方又は両方から抽出された過剰水分は、分離器又は突出ドラムに蓄積することができる。このように蓄積された過剰水分は、その後再循環させて、冷媒流体又は加湿用水分のソースとして使用してもよいし、或いは単に装置から排出してもよい。

燃料電池に供給される反応体の一つが実質的に純粋な水素又は酸素である場合には、反応体を大気中に排気するから生じる廃棄物を最小限に抑えるため、燃料電池から排出される未消費反応体を再循環させてもよい。再循環させる反応体流を、その過剰水分を除去してから、対応する新たな反応体導入流と燃料電池スタ

ックへの入口の上流で合流させてもよい。別法として、再循環させる反応体流を、水蒸気を含有させたまま新たな反応体導入流と直接合流させることにより、その新たな反応体導入流を加湿し、独立した加湿器を不要とすることもできる。

同様に、反応体の一方又は両方が、改質物や空気のように希薄な反応体である場合にも、燃料電池から排出される未消費反応体を、特に燃料流の場合に、再循環させることができる。しかしながら、

希薄な反応体流は、特にそれが空気の場合に、燃料電池スタックを一度通過した後に廃棄される場合が多い。希薄な反応体流の出口における過剰な水分は、分離器又は突出ドラムにおいて除去されることが一般的である。その後、反応体排気流は大気中に放出されることが一般的である。

反応体流の出口から分離された生成物の水を冷媒流と合体させることにより、燃料電池スタックにおいて電気化学的に生じた生成物の水を使用してスタックの温度を調節することが往々にして有利である。この点において、生成物の水を冷媒として使用すると、冷媒流体源を外部に独立して設ける必要がなくなる。燃料電池により生成する水はそれ自体が好適な冷媒流体となるからである。

反応体流を再循環させて使用する装置を特徴付ける場合、用語「再循環比」を定義すると便利である。本明細書中、「再循環比」とは、燃料電池スタックへの反応体供給量を、燃料電池スタックを１回通過した際の反応体消費量で割り算して得られる比率をいう。典型的な水素／酸素系燃料電池スタックの場合、水素の再循環比は１．２～５．０、より好ましくは１．５～２．０の範囲にある。

一又は二以上の反応体流を再循環させる燃料電池系発電装置には、再循環を行うために真空イジェクター(vacuum ejector)が用いられている。Winters の米国特許第３，４６２，３０８号明細書に、イジェクター２３、２３’によって、燃料電池から排出された燃料流及び酸化剤流の各々を再循環させ、それぞれの新たに導入される燃料流及び酸化剤流と合流させる燃料電池装置が開示されている。各イジェクターは、ベンチュリ・スロートを含むものとして記載されている。しかしながら、Winters のイジェクター形状は、各イジェクターの通過に一定の反応体流の圧力降下が必要である固定点運転用に設計されている。イジェクターの

通過に必要な圧力降下を維持

するため、Winters の装置は、必要に応じガス抜き弁２１、２１’を介して再循環反応体流を廃棄する。このように、Winters の反応体再循環装置は負荷追従能(load-following capability)を示すが、再循環反応体流の大気中への排気による重大な効率上の不利を招く。

真空イジェクターはまた、改質物系燃料電池発電システムの燃料処理二次システムにも導入されている。Fanciullo らの米国特許第３，７４５，０４７号明細書では、イジェクターを用いて流れを燃料流に引き込んでからそれを改質器へ導入している。しかしながら、Fanciullo らのシステムでは、燃料流（又は酸化剤流）の再循環にイジェクターを使用することはない。これは、出口の燃料流が、燃料電池へは再循環されず、その代わりに導管３４を介して改質器のバーナーに向けられるからである。

イジェクターの主目的は、気体、液体、粉体又は固体粒子を、ある圧力レベルから比較的高い圧力レベルへ移送することにある。イジェクターは一般に推進部を含まず、それゆえ受動装置と見なされる。イジェクター内では、加圧された推進流体がノズルを通過し、その際、流体がノズルの口部から出るときに圧力が散逸され、流体を加速する。このノズルを出ていく高速の流体の流れが、吸入口でイジェクターに導入された比較的低圧の流体を連行する。低圧の吸引流体が推進流体により連行されることで、吸引流体は推進流体と共に移動する。これら二種の流れは、イジェクターのディフューザー部内を通過する際に混合する。流れの速度プロフィールはイジェクターの流路に沿って変化し、そして流れの圧力は、流体がイジェクターの出口に到達すると上昇する。推進流体の流速が上昇するにつれ、イジェクターのノズルを横切る圧力降下幅が増大するため、排出圧を一定に維持するためには推進圧も上昇させる必要がある。推進／排出圧力の上昇と共に、吸引流体の流速も上昇する。

発明の概要

一実施態様において、本発明は、

（ａ）燃料流の入口と、燃料流の出口と、酸化剤流の入口と、該燃料流の入口から導入された燃料流と該酸化剤流の入口から導入された酸化剤流との電気触媒反応を促進して電気、反応生成物及び熱を得るための少なくとも一つの燃料電池とを含んで成る燃料電池スタック；

（ｂ）燃料供給圧を調節するための圧力制御弁を有する加圧された燃料供給部；

（ｃ）該燃料供給部と該燃料流の入口との間に挿入された真空イジェクターであって、推進用入口と、吸入口と、排出口とを含み、該推進用入口と該燃料供給部とは流体が通るように接続されており、該吸入口と該燃料流の出口とは流体が通るように接続されており、そして該排出口と該燃料流の入口とは流体が通るように接続されている真空イジェクター；

（ｄ）該燃料流において該排出口と該吸入口との間に挿入された圧力変換器であって、該燃料流の圧力を検出して対応する信号を該圧力制御弁へ伝送する圧力変換器；及び

（ｅ）該酸化剤流の入口と流体が通るように接続されている加圧された酸化剤供給部

を含んで成る発電装置を包含する。

運転時、圧力変換器は、負荷が増大し、その結果燃料流のイジェクター通過流速が上昇すると起こるであろう燃料流の圧力の所定の値を下回る低下を検出した時に、燃料供給圧を上昇させる信号を圧力制御弁に伝送する。反対に、圧力変換器は、負荷が減少し、その結果燃料流のイジェクター通過流速が低下すると起こるであろう燃料流の圧力の所定の値を上回る上昇を検出した時には、燃料供給圧を低下させる信号を圧力制御弁に伝送する。

好ましい発電装置では、燃料電池スタックはさらに酸化剤流の出口を含む。圧力変換器は、燃料流において、前記排出口と燃料流の入口との間に挿入されることが好ましい。

圧力変換器によって伝送される信号は、燃料流の検出圧に相当する電気信号、液圧信号又は空気圧信号が圧力制御弁へ伝送されるよう、電気的又は機械的であ

ることができる。

好ましい装置では、加圧された供給燃料は実質的に純粋な水素を含む。加圧された供給酸化剤は酸素を含むことが好ましい。好ましい供給酸化剤は含酸素空気である。燃料が水素であり且つ酸化剤が酸素である場合、その反応生成物は水となる。

好ましい装置では、燃料電池の各々はイオン交換膜を含み、そして該装置はさらに、燃料流に水蒸気を付与するための燃料流加湿器及び酸化剤流に水蒸気を付与するための酸化剤流加湿器を含む。燃料流出口と吸入口との間に水分離器を挿入し、燃料流中に含まれる水分の少なくとも一部を除去することが好ましい。

最も好ましい装置では、酸化剤供給部は、酸化剤流の圧力上昇を検出した時には燃料供給圧を上昇させる信号を圧力制御弁に伝送し、且つ、酸化剤流の圧力低下を検出した時には燃料供給圧を低下させる信号を圧力制御弁に伝送するように、酸化剤流の圧力を検出して対応する信号を圧力制御弁へ伝送するための圧力変換器を有する。

別の実施態様では、本発明は、

（ａ）燃料流の入口と、酸化剤流の入口と、酸化剤流の出口と、該燃料流の入口から導入された燃料流と該酸化剤流の入口から導入された酸化剤流との電気触媒反応を促進して電気、反応生成物及び熱を得るための少なくとも一つの燃料電池とを含んで成る燃料電池スタック；

（ｂ）酸化剤供給圧を調節するための圧力制御弁を有する加圧された酸化剤供給部；

（ｃ）該酸化剤供給部と該酸化剤流の入口との間に挿入された真空イジェクターであって、推進用入口と、吸入口と、排出口とを含み、該推進用入口と該酸化剤供給部とは流体が通るように接続されており、該吸入口と該酸化剤流の出口とは流体が通るように接続されており、そして該排出口と該酸化剤流の入口とは流体が通るように接続されている真空イジェクター；

（ｄ）該酸化剤流において該排出口と該吸入口との間に挿入された圧力変換器であって、該酸化剤流の圧力を検出して対応する信号を該圧力制御弁へ伝送する

圧力変換器；及び

（ｅ）該燃料流の入口と流体が通るように接続されている加圧された燃料供給部

を含んで成る発電装置を包含する。

運転時、圧力変換器は、酸化剤流の圧力の所定の値を下回る低下を検出した時に、酸化剤供給圧を上昇させる信号を圧力制御弁に伝送する。反対に、圧力変換器は、酸化剤流の圧力の所定の値を上回る上昇を検出した時には、酸化剤供給圧を低下させる信号を圧力制御弁に伝送する。

好ましい発電装置では、燃料電池スタックはさらに燃料流の出口を含む。圧力変換器は、酸化剤流において、前記排出口と酸化剤流の入口との間に挿入されることが好ましい。加圧された供給酸化剤は実質的に純粋な酸素を含むことが好ましい。

最も好ましい装置では、燃料供給部は、燃料流の圧力上昇を検出した時には酸化剤供給圧を上昇させる信号を圧力制御弁に伝送し、且つ、燃料流の圧力低下を検出した時には酸化剤供給圧を低下させる信号を圧力制御弁に伝送するように、燃料流の圧力を検出して対

応する信号を圧力制御弁へ伝送するための圧力変換器を有する。

別の実施態様では、本発明は、燃料電池スタックと、加圧された第一の反応体供給部であって、該反応体供給部の圧力を調節するための圧力制御弁を有するものと、加圧された第二の反応体供給部とを含む発電装置において、第一の反応体流を再循環させる方法を包含する。この方法は、以下の工程を含む。

（ａ）推進用入口と、吸入口と、排出口とを含む真空イジェクターを、第一の反応体供給部とスタックの第一の反応体流の入口との間に挿入する工程；

（ｂ）該推進用入口を該第一の反応体供給部と流体が通るように接続する工程；

（ｃ）該吸入口を該スタックの第一の反応体流の出口と流体が通るように接続する工程；

（ｄ）該排出口を第一の反応体流の入口と流体が通るように接続する工程；

（ｅ）該第一の反応体流の圧力を検出して対応する信号を該圧力制御弁に伝送することができる圧力変換器を、該排出口と該第一の反応体流の入口との間に挿入する工程；

（ｆ）該第一の反応体流の圧力の所定の値を下回る低下を検出した時に、圧力変換器から該第一の反応体の供給圧を上昇させる信号を圧力制御弁に伝送する工程；及び

（ｇ）該第一の反応体流の圧力の所定の値を上回る上昇を検出した時に、圧力変換器から該第一の反応体の供給圧を低下させる信号を圧力制御弁に伝送する工程。

好ましい方法では、該第一の反応体流は水素を含み、且つ、該第二の反応体流は酸素を含む。

最も好ましい方法は、さらに以下の工程を含む。

（ｈ）該第二の反応体流の圧力を検出して対応する信号を該圧力制御弁に伝送することができる第二反応体圧力変換器を、該スタックの第二の反応体流の入口と第二の反応体供給部との間に挿入する工程；

（ｉ）該第二の反応体流の圧力の上昇を検出した時に、圧力変換器から該第一の反応体の供給圧を上昇させる信号を圧力制御弁に伝送する工程；及び

（ｊ）該第二の反応体流の圧力の低下を検出した時に、該第一の反応体の供給圧を低下させる信号を圧力制御弁に伝送する工程。

図面の簡単な説明

第１図は、流体燃料流れの再循環のための調節された真空イジェクターを具備した燃料電池系発電装置の一実施態様の概略図である。

第２図は、第１図で概略的に図示した真空イジェクターの横断面図である。

好ましい実施態様の詳細な説明

まず、第１図を参照するが、燃料電池系発電装置１０は燃料電池スタック１００、好ましくは複数の燃料電池を含むもの、を含む。この燃料電池スタック１００については、Watkins らの米国特許第５，２００，２７８号明細書（図１～６及び添付のテキスト）により詳細に記載されており、本明細書ではこれを参照す

ることによりその全体を援用する。スタック１００を構成するタイプの燃料電池のための好ましい反応体の供給及び制御システムについては、Merritt らの米国特許第５，３６６，８２１号明細書に記載されており、本明細書ではこれも参照することによりその全体を援用する。

スタック１００の燃料電池は、以下詳細に説明するように、それ

ぞれがアノード、カソード、電解質（好ましくは固体ポリマーイオン交換膜）及び冷却／加湿単位装置を有する。第１図に概略的に図示したように、燃料電池スタック１００は、燃料流の入口１１０、燃料流の出口１１２、酸化剤流の入口１１４、酸化剤流の出口１１６、冷媒／加湿流体の入口１１８及び冷媒／加湿流体の出口１１９を含む。

燃料電池スタック１００は、負及び正の母線プレート（それぞれ１０２、１０４）を含み、これらに可変負荷１０６及び接触スイッチ１０８を含む回路が電気的に接続されている。装置１０は、スタック１００の他にも、燃料循環路、酸化剤循環路及び冷却／加湿循環路を含む。

第１図の装置１０の燃料循環路は、燃料供給ライン１３６を有する加圧された実質的に純粋な水素供給部１２０を含む。図示し以下詳細に説明するように、信号を受信しこれに応答することができる圧力制御弁１２２が、供給ライン１３６からの燃料流の圧力を調節する。燃料供給部１２０とスタック１００の燃料流の入口１１０との間には、真空イジェクター１２４が挿入されている。

イジェクター１２４は、推進用入口１２６、吸入口１２８及び排出口１３０を含む。推進用入口１２６は、図示したように、圧力制御弁１２２の出口に流体が通るように接続されており、そして加圧された燃料流１３６を受ける。吸入口１２８は、スタック１００の燃料流の出口１１２に流体が通るように接続されており、排出燃料流１４２が再循環される。スタック１００の燃料流の出口１１２とイジェクター１２４の吸入口１２８との間には、水分離器又は突出ドラム１４４が挿入されている。水分離器１４４は、イジェクター１２４の吸入口１２８へ流れ１４６を向ける前に、排出燃料流１４２に含まれる水分の少なくとも一部を除去する。このように、再循

環された燃料流１４６と新たな加圧燃料流１３８との合体により、導入燃料流１４０が形成される。

イジェクター１２４の排出口１３０は、スタック１００の燃料流の入口１１０に流体が通るように接続されている。排出口１３０と燃料流の入口１１０との間には、圧力変換器１３２が挿入されている。圧力変換器１３２は導入燃料流１４０の圧力を検出し、そして導入燃料流１４０において検出された圧力に対応する信号を伝送することができる。圧力変換器１３２から圧力制御弁１２２への信号は、第１図において破線で示したが、電気的信号であっても、機械的信号であってもよい。この点では、導入燃料流の検出圧に対応する電気信号、液圧信号又は空気圧信号が、圧力変換器１３２から圧力制御弁１２２へ伝送される。運転中は、導入燃料流１４０の検出圧が所定の値、典型的には約１．３８×10^5～３．４５×10^5Pa（２０～５０ psi）のゲージ圧、公称では約２．０７×10^5Pa（３０ psi）のゲージ圧、を下回った時に、燃料流１３８の圧力を高めるように圧力変換器１３２が信号を圧力制御弁１２２へ伝送する。負荷が増大し、その結果燃料流のイジェクター通過流速が上昇した場合には、導入燃料流１４０の検出圧は所定の値を下回るであろう。反対に、導入燃料流１４０の検出圧が所定の値を上回った時には、燃料流１３８の圧力を低めるように圧力変換器１３２が信号を圧力制御弁１２２へ伝送する。負荷が減少し、その結果燃料流のイジェクター通過流速が低下した場合には、導入燃料流１４０の検出圧は所定の値を上回るであろう。圧力変換器１３２と圧力制御弁１２２の相互作用により、イジェクター１２４を負荷追従性にすることができ、従って、燃料電池スタックへの導入燃料流の圧力を一連の潜在的な運転条件にわたり比較的一定に維持することができると共に、排出燃料流の再循環比を比較的一定に維持することができる。

第１図における装置１０の酸化剤循環路は、導入酸化剤流１５２の源として、加圧された含酸素空気供給部１５０を含む。酸化剤供給部１５０と酸化剤流の入口１１４との間に、圧力変換器１５６が挿入されている。圧力変換器１５６は導入酸化剤流１５２の圧力を検出し、そして導入酸化剤流１５２において検出され

た圧力に対応する信号を伝送することができる。圧力変換器１５６から圧力制御弁１２２への信号は、第１図において破線で示したが、電気的信号であっても、機械的信号であってもよい。この点では、導入燃料流の検出圧に対応する電気信号、液圧信号又は空気圧信号が、圧力変換器１５６から圧力制御弁１２２へ伝送される。運転中は、導入酸化剤流１５２の検出圧が上昇した時に、燃料流１３８の圧力を高めるように圧力変換器１５６が信号を圧力制御弁１２２へ伝送する。反対に、導入酸化剤流１５２の検出圧が低下した時には、燃料流１３８の圧力を低めるように圧力変換器１５６が信号を圧力制御弁１２２へ伝送する。このように、圧力変換器１５６は、導入燃料流１４０の圧力と導入酸化剤流１５２の圧力との間のバランスを維持するように、圧力制御弁１２２に対してバイアスとして作用する。

排出酸化剤流１５４は、酸化剤流の出口１１６を介してスタック１００から排出される。水分離器又は突出ドラム１５６が、排出酸化剤流１５４に含まれる水分の少なくとも一部を除去する。第１図に図示したように、水分離器１５６からの排出酸化剤流１５８は、装置１０から大気へ排出される。

第１図中の装置１０の冷却／加湿循環路は、溜１６２を含む。溜１６２は、水分離器１４４、１５６から、排出燃料流及び排出酸化剤流から除去された水を受けることができる。溜１６２からの冷媒／加湿流体の流れ１６４は、ポンプ１６６により、加圧された流れ

１６８として、スタック１００の冷媒／加湿流体の入口１１８へ送り込まれる。排出冷媒／加湿流体の流れ１７０は、冷媒／加湿流体の出口１１９を介してスタック１００から排出される。その後、第１図に図示したように、排出冷媒／加湿流体の流れ１７０は溜１６２に戻される。

第２図は、第１図で概略的に図示した真空イジェクター１２４の横断面図である。真空イジェクター１２４は推進用入口１２６、吸入口１２８及び排出口１３０を含む。イジェクター１２４は、さらに推進ノズル２０２、推進チェスト２０４、ディフューザー部２０６、導入ディフューザー２０８、ディフューザー・スロート２１０及び排出ディフューザー２１２を含む。

更に、流体酸化剤の流れを再循環させるために酸化剤流として実質的に純粋な酸素を使用する燃料電池系発電装置に、真空イジェクターを導入することも可能である。この点では、流体燃料の流れの真空イジェクターによる再循環について上述した原理と本質的に同じ原理が、流体酸化剤の流れの真空イジェクターによる再循環に当てはまるであろう。

本発明の特定の要素、実施態様及び応用について示し説明してきたが、本発明はこれらに限定はされず、当業者であれば、特に上記の教示により変更が可能であることは理解されよう。従って、このような変更を本発明の精神及び範囲内に包含される特徴を含むものとして、添付の請求の範囲は意図するものである。

【図１】

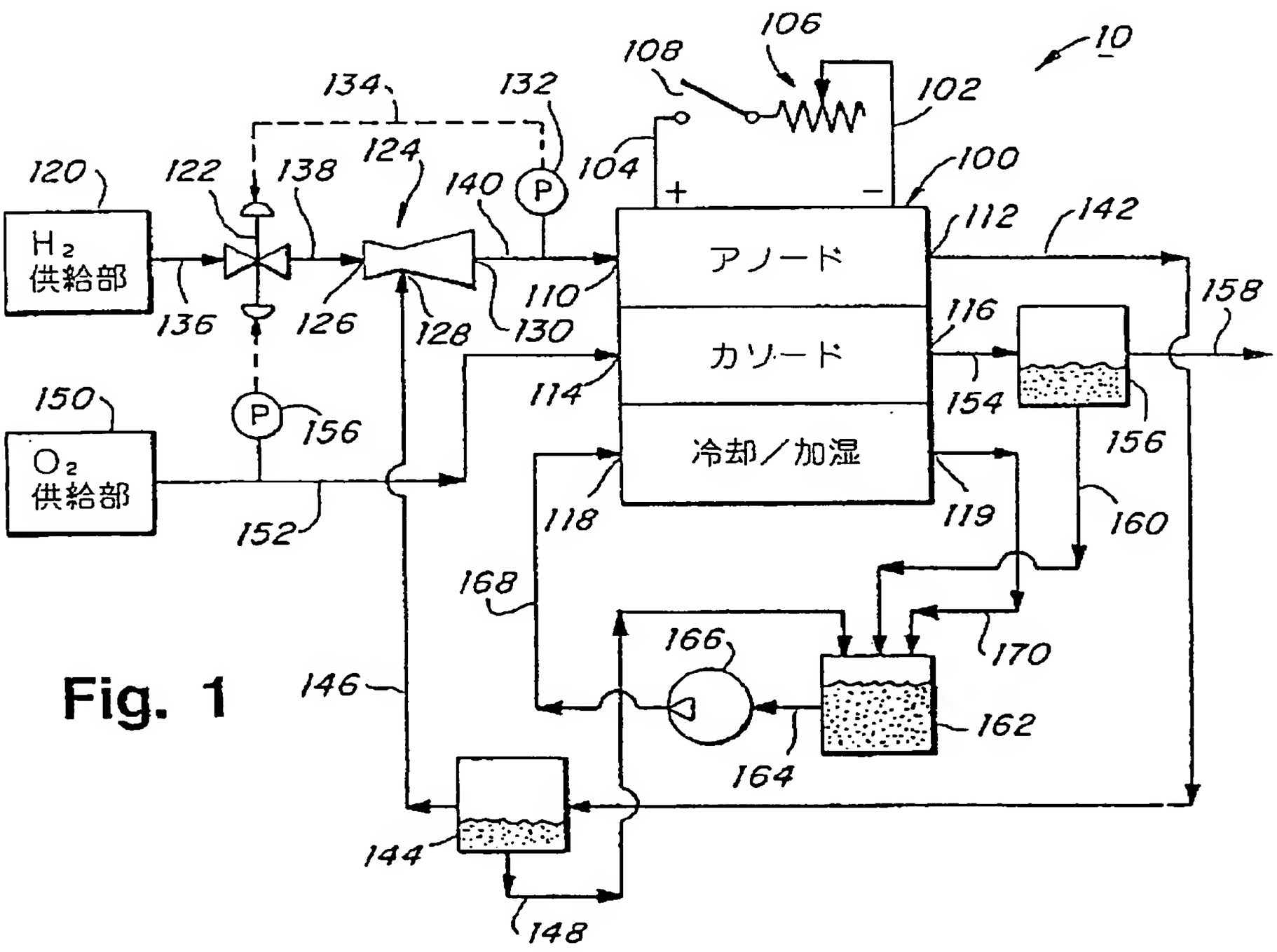

Fig. 1

【図２】

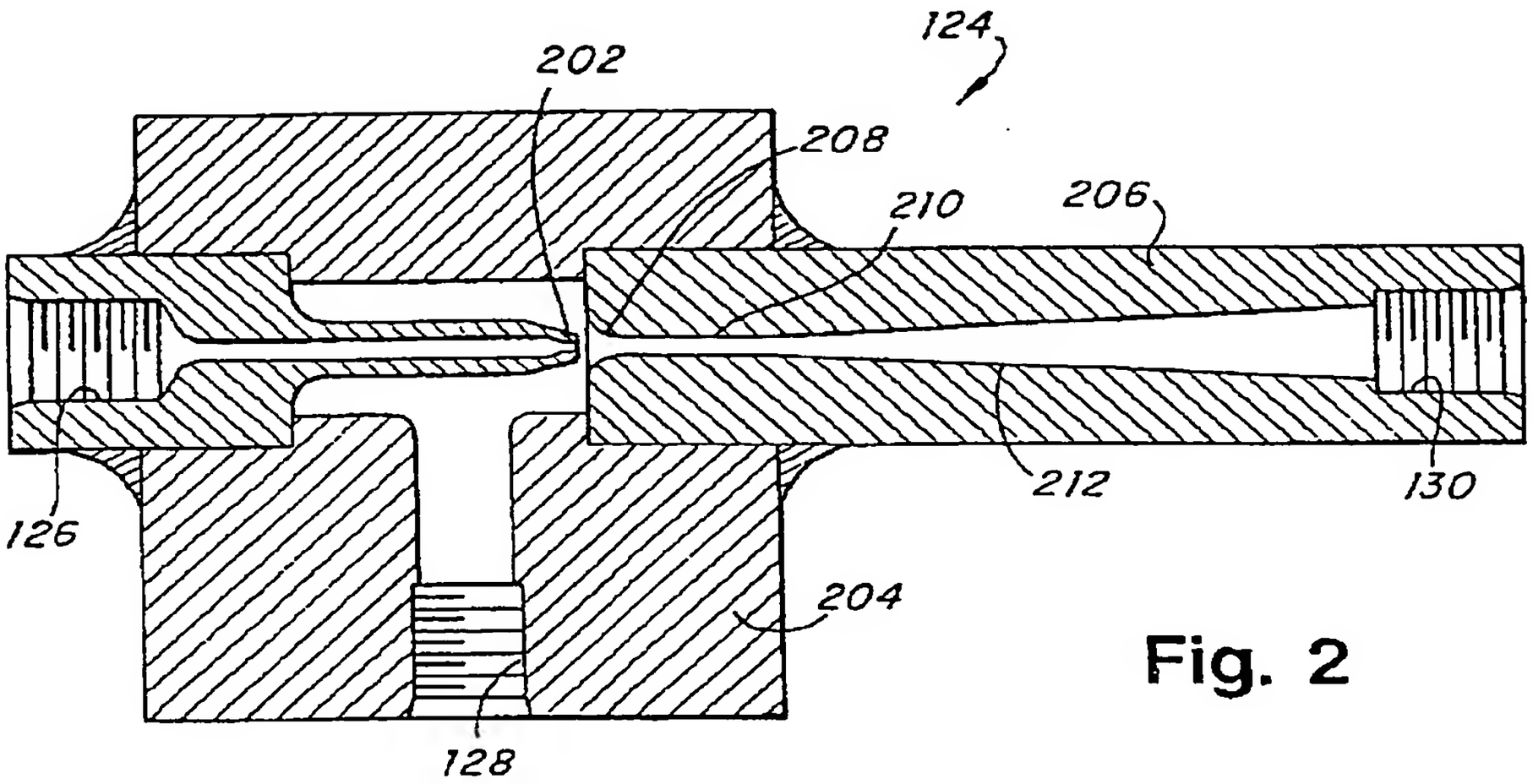

Fig. 2

【手続補正書】特許法第１８４条の８第１項

【提出日】１９９６年１２月１０日

【補正内容】

請求の範囲

１．（ａ）第一反応体流の入口と、第一反応体流の出口と、第二反応体流の入口と、前記第一反応体流の入口で導入された第一反応体流と前記第二反応体流の入口で導入された第二反応体流との電気触媒反応を促進して電気、反応生成物及び熱を得るための少なくとも一つの燃料電池とを含んで成る燃料電池スタック；

（ｂ）第一反応体供給圧を調節するための圧力制御弁を有する加圧された第一反応体供給部；

（ｃ）前記第一反応体供給部と前記第一反応体流の入口との間に挿入された真空イジェクターであって、推進用入口と、吸入口と、排出口とを含み、前記推進用入口と前記第一反応体供給部とは流体が通るように接続されており、前記吸入口と前記第一反応体流の出口とは流体が通るように接続されており、そして前記排出口と前記第一反応体流の入口とは流体が通るように接続されている真空イジェクター；

（ｄ）前記第一反応体流において前記排出口と前記吸入口との間に挿入された第一圧力変換器であって、前記第一反応体流の圧力を検出して対応する信号を前記圧力制御弁へ伝送する第一圧力変換器；

（ｅ）前記第二反応体流の入口と流体が通るように接続されている加圧された第二反応体供給部；及び

（ｆ）前記第二反応体供給部と前記第二反応体流の入口との間に挿入された第二圧力変換器であって、前記第二反応体流の圧力を検出して対応する信号を前記圧力制御弁へ伝送する第二圧力変換器

を含んで成る発電装置であって、

前記第一圧力変換器は、前記第一反応体流の検出圧が所定の値を下回った時には信号を前記圧力制御弁に伝送して前記第一反応体供給圧を上昇させ、且つ、前記第一圧力変換器は、前記第一反応体流の検出圧が所定の値を上回った時には信

号を前記圧力制御弁に伝送して前記第一反応体供給圧を低下させ、且つ、

前記第二圧力変換器は、前記第二反応体流の検出圧が上昇した時には信号を前記圧力制御弁に伝送して前記第一反応体供給圧を上昇させ、且つ、前記第二圧力変換器は、前記第二反応体流の検出圧が低下した時には信号を前記圧力制御弁に伝送して前記第一反応体供給圧を低下させる発電装置。

２．前記燃料電池スタックがさらに第二反応体流の出口を含む、請求項１に記載の発電装置。

３．前記第一圧力変換器が、前記第一反応体流において、前記排出口と前記第一反応体流の入口との間に挿入されている、請求項１に記載の発電装置。

４．前記第一圧力変換器が、前記第一反応体流の検出圧に相当する電気信号を前記圧力制御弁へ伝送する、請求項１に記載の発電装置。

５．前記第一圧力変換器が、前記第一反応体流の検出圧に相当する液圧信号を前記圧力制御弁へ伝送する、請求項１に記載の発電装置。

６．前記第一圧力変換器が、前記第一反応体流の検出圧に相当する空気圧信号を前記圧力制御弁へ伝送する、請求項１に記載の発電装置。

７．前記第一反応体が燃料であり且つ前記第二反応体が酸化剤である、請求項１に記載の発電装置。

８．前記加圧された第一反応体供給部が実質的に純粋な水素を含む、請求項７に記載の発電装置。

９．前記加圧された第二反応体供給部が酸素を含み且つ前記反応生成物が水である、請求項８に記載の発電装置。

10. 前記第二反応体供給部が含酸素空気である、請求項９に記載の発電装置。

11. 前記燃料電池の少なくとも一つがイオン交換膜を含み、そして前記装置はさらに、前記第一反応体流に水蒸気を付与するための第一反応体流加湿器及び前記第二反応体流に水蒸気を付与するための第二反応体流加湿器を含む、請求項１に記載の発電装置。

12. 前記第一反応体流の出口と前記吸入口との間に水分離器を挿入し、よって前記第一反応体流中に含まれる水分の少なくとも一部を除去する、請求項11に記

載の発電装置。

13. 第一反応体流の入口と、第一反応体流の出口と、第二反応体流の入口と、前記第一反応体流の入口で導入された前記第一反応体流と前記第二反応体流の入口で導入された前記第二反応体流との電気触媒反応を促進して電気、反応生成物及び熱を得るための少なくとも一つの燃料電池とを含む燃料電池スタックを含んで成り、さらに、加圧された第一反応体供給部であって、前記第一反応体供給部の圧力を調節するための圧力制御弁を有するものと、加圧された第二反応体供給部とを含んで成る発電装置において、第一反応体流を再循環させる方法であって

（ａ）推進用入口と、吸入口と、排出口とを含む真空イジェクターを、前記第一反応体供給部と前記第一反応体流の入口との間に挿入する工程；

（ｂ）前記推進用入口を前記第一反応体供給部と流体が通るように接続する工程；

（ｃ）前記吸入口を前記第一反応体流の出口と流体が通るように接続する工程；

（ｄ）前記排出口を前記第一反応体流の入口と流体が通るように接続する工程；

（ｅ）前記第一反応体流の圧力を検出して対応する信号を前記圧力制御弁に伝送することができる第一圧力変換器を、前記排出口と前記吸入口との間に挿入する工程；

（ｆ）前記第一反応体流の検出圧が所定の値を下回った時に、信号を前記圧力制御弁に伝送して前記第一反応体の供給圧を上昇させる工程；

（ｇ）前記第一反応体流の検出圧が所定の値を上回った時に、信号を前記圧力制御弁に伝送して前記第一反応体の供給圧を低下させる工程

（ｈ）前記第二反応体流の圧力を検出して対応する信号を前記圧力制御弁に伝送することができる第二圧力変換器を、前記第二反応体流の入口と前記第二反応体供給部との間に挿入する工程；

（ｉ）前記第二反応体流の検出圧が上昇した時に、信号を前記圧力制御弁に伝

送して前記第一反応体の供給圧を上昇させる工程；及び

（ｊ）前記第二反応体流の検出圧が低下した時に、信号を前記圧力制御弁に伝送して前記第一反応体の供給圧を低下させる工程

を含む前記方法。

14．前記第一反応体流が水素を含み、且つ、前記第二反応体流が酸素を含む、請求項13に記載の方法。

【国際調査報告】

INTERNATIONAL SEARCH REPORT

International Application No
PCT/CA 95/00720

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 H01M8/04

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 H01M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US,A,3 748 180 (CLAUSI J ET AL) 24 July 1973 see column 2, line 52 - line 67; figure 1 see column 3, line 12 - line 18	1-3,6-8, 12,24-26
A		11
Y		10-15, 18-21

Y	PATENT ABSTRACTS OF JAPAN vol. 94, no. 011 & JP,A,06 325780 (MITSUBISHI HEAVY IND LTD), 25 November 1994, see abstract	10,11

	-/--	

[X] Further documents are listed in the continuation of box C. [X] Patent family members are listed in annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
25 April 1996	14.05.96
Name and mailing address of the ISA European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+ 31-70) 340-2040, Tx. 31 651 epo nl, Fax (+ 31-70) 340-3016	**Authorized officer** D'hondt, J

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Int ional Application No
PCT/CA 95/00728

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	PATENT ABSTRACTS OF JAPAN vol. 018, no. 658 (E-1643), 13 December 1994 & JP,A,06 260198 (MITSUBISHI HEAVY IND LTD), 16 September 1994, see abstract	10, 13-15, 18-21
Y	PATENT ABSTRACTS OF JAPAN vol. 010, no. 032 (E-379), 7 February 1986 & JP,A,60 189176 (TOSHIBA KK), 26 September 1985, see abstract	12
Y	PATENT ABSTRACTS OF JAPAN vol. 009, no. 165 (E-327), 10 July 1985 & JP,A,60 039772 (TOSHIBA KK), 1 March 1985, see abstract	12
Y	PATENT ABSTRACTS OF JAPAN vol. 008, no. 229 (E-273), 20 October 1984 & JP,A,59 111272 (TOSHIBA KK), 27 June 1984, see abstract	12
X	PATENT ABSTRACTS OF JAPAN vol. 007, no. 107 (E-174), 11 May 1983 & JP,A,58 030075 (FUJI DENKI SEIZO KK;OTHERS: 01), 22 February 1983, see abstract	1-3,24
P,X	FR,A,2 712 099 (IMRA EUROP SA) 12 May 1995 see page 5, line 20 - page 6, line 6; claims 1,5; figure 1	1,4,7, 24,25
A	PATENT ABSTRACTS OF JAPAN vol. 005, no. 192 (E-085), 8 December 1981 & JP,A,56 114287 (CENTRAL RES INST OF ELECTRIC POWER IND;OTHERS: 01), 8 September 1981, see abstract	1
A	US,A,3 716 415 (GAGNON R ET AL) 13 February 1973 see figure 1	1
A	US,A,3 368 923 (SMITH GEORGE E) 13 February 1968	
A	PATENT ABSTRACTS OF JAPAN vol. 010, no. 213 (E-422), 25 July 1986 & JP,A,61 051771 (MITSUBISHI ELECTRIC CORP), 14 March 1986, see abstract	

フロントページの続き

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【要約の続き】
力とのバランスを維持する。

CLAIMS

[Claim(s)]
1.(a) Fuel cell stack which changes including at least one fuel cell for promoting electrocatalysis reaction of fuel style introduced at inlet port of fuel style, outlet of fuel style, inlet port of oxidizer style, and inlet port of said fuel style, and oxidizer style introduced at inlet port of said oxidizer style, and obtaining electrical and electric equipment, resultant, and heat;
(b) Pressurized fuel feed zone which has a pressure control valve for adjusting a fuel supply pressure;
(c) It is the vacuum ejector connected by connecting so that it is the vacuum ejector inserted between said fuel feed zones and inlet ports of said fuel style, it may connect so that a fluid may pass along said inlet port for promotion and said fuel feed zone including the inlet port for promotion, inhalation opening, and an exhaust port, and a fluid may pass along said inhalation opening and outlet of said fuel style so that a fluid may pass along said exhaust port and inlet port of said fuel style.;
(d) It is the pressure transducer inserted between said exhaust ports and said inhalation openings in said fuel style. The pressure transducer which transmits the signal which detects the pressure of said fuel style and corresponds to said pressure control valve; it reaches. (e) It is the power plant which changes including the pressurized oxidizer feed zone which is connected so that the inlet port and fluid of said oxidizer style may pass. When the detection pressure of said fuel style is less than a predetermined value, said pressure transducer transmits a signal to said pressure control valve, and raises said fuel supply pressure. And said pressure transducer The power plant to which a signal is transmitted to said pressure control valve, and said fuel supply pressure is reduced when the detection pressure of said fuel style exceeds a predetermined value.
2. Power plant according to claim 1 with which said fuel cell stack includes outlet of oxidizer style further.
3. Power plant according to claim 1 with which said pressure transducer is inserted between said exhaust ports and inlet ports of said fuel style in said fuel style.
4. Power plant according to claim 1 which transmits electrical signal with which said pressure transducer is equivalent to detection pressure of said fuel style to said pressure control valve.
5. Power plant according to claim 1 which transmits fluid pressure signal with which said pressure transducer is equivalent to detection pressure of said fuel style to said pressure control valve.
6. Power plant according to claim 1 which transmits air pressure signal with which said pressure transducer is equivalent to detection pressure of said fuel style to said pressure control valve.
7. Power plant according to claim 1 with which said pressurized fuel feed zone contains pure hydrogen substantially.
8. Power plant according to claim 7 said whose resultant said pressurized oxidizer feed zone is water, including oxygen.
9. Power plant according to claim 8 said whose oxidizer feed zone is oxygenated air.
10. For said equipment, at least one of said the fuel cells is a power plant containing the oxidizer style humidifier for giving a steam the fuel style humidifier and said oxidizer style for giving a steam in the style of [said] a fuel according to claim 1 further including ion exchange membrane.
11. The power plant according to claim 10 from which a water separator is inserted between the outlet of said fuel style, and said inhalation opening, and a part of moisture [at least] therefore contained in said fuel style is removed.

12. It Has Pressure Transducer for Transmitting Signal with which Said Oxidizer Feed Zone Detects Pressure of Said Oxidizer Style, and Corresponds to Said Pressure Control Valve. Therefore, when the detection pressure of said oxidizer style rises, the pressure transducer of said oxidizer style transmits a signal to said pressure control valve, and raises said fuel supply pressure. And the power plant according to claim 1 to which the pressure transducer of said oxidizer style transmits a signal to said pressure control valve, and reduces said fuel supply pressure when the detection pressure of said oxidizer style falls.
13.(a) Fuel cell stack which changes including at least one fuel cell for promoting the electrocatalysis reaction of the fuel style introduced at the inlet port of a fuel style, the inlet port of an oxidizer style, the outlet of an oxidizer style, and the inlet port of said fuel style, and the oxidizer style introduced at the inlet port of said oxidizer style, and obtaining the electrical and electric equipment, a resultant, and heat;
(b) Pressurized oxidizer feed zone which has a pressure control valve for adjusting an oxidizer supply pressure;
(c) It is the vacuum ejector connected by connecting so that it is the vacuum ejector inserted between said oxidizing agent feed zones and inlet ports of said oxidizing agent style, it may connect so that a fluid may pass along said inlet port for promotion and said oxidizing agent feed zone including the inlet port for promotion, inhalation opening, and an exhaust port, and a fluid may pass along said inhalation opening and outlet of said oxidizing agent style so that a fluid may pass along said exhaust port and inlet port of said oxidizing agent style.;
(d) It is the pressure transducer inserted between said exhaust ports and said inhalation openings in said oxidizer style. The pressure transducer which transmits the signal which detects the pressure of said oxidizer style and corresponds to said pressure control valve; it reaches. (e) It is the power plant which changes including the pressurized fuel feed zone which is connected so that the inlet port and fluid of said fuel style may pass. When the detection pressure of said oxidizer style is less than a predetermined value, said pressure transducer transmits a signal to said pressure control valve, and raises said oxidizer supply pressure. And said pressure transducer The power plant to which a signal is transmitted to said pressure control valve, and said oxidizer supply pressure is reduced when the detection pressure of said oxidizer style exceeds a predetermined value.
14. The power plant according to claim 13 with which said fuel cell stack includes the outlet of a fuel style further.
15. The power plant according to claim 13 with which said pressure transducer is inserted between said exhaust ports and inlet ports of said oxidizer style in said oxidizer style.
16. The power plant according to claim 13 which transmits the electrical signal with which said pressure transducer is equivalent to the detection pressure of said oxidizer style to said pressure control valve.
17. The power plant according to claim 13 which transmits the fluid pressure signal with which said pressure transducer is equivalent to the detection pressure of said oxidizer style to said pressure control valve.
18. The power plant according to claim 13 which transmits the air pressure signal with which said pressure transducer is equivalent to the detection pressure of said oxidizer style to said pressure control valve.
19. The power plant according to claim 13 with which said pressurized oxidizer feed zone contains pure oxygen substantially.
20. The power plant according to claim 19 said whose resultant said pressurized fuel feed zone is water, including hydrogen.
21. For said equipment, at least one of said the fuel cells is a power plant containing the oxidizer style humidifier for giving a steam the fuel style humidifier and said oxidizer style for giving a steam in the style of [said] a fuel according to claim 13 further including ion exchange membrane.
22. The power plant according to claim 21 from which a water separator is inserted between the outlet of said oxidizer style, and said inhalation opening, and a part of moisture [at least] therefore contained in said oxidizer style is removed.
23. It Has Pressure Transducer for Transmitting Signal with which Said Fuel Feed Zone Detects Pressure of Said Fuel Style, and Corresponds to Said Pressure Control Valve. Therefore, when the detection pressure of said fuel style rises, the pressure transducer of said fuel style transmits a signal

to said pressure control valve, and raises said oxidizer supply pressure. And the power plant according to claim 13 to which the pressure transducer of said fuel style transmits a signal to said pressure control valve, and reduces said oxidizer supply pressure when the detection pressure of said fuel style falls.

24. Inlet Port of First Reagin Style, Outlet of First Reagin Style, and Inlet Port of Second Reagin Style, The electrocatalysis reaction of said first reagin style introduced at the inlet port of said first reagin style and said second reagin style introduced at the inlet port of said second reagin style is promoted. The electrical and electric equipment, What changes including the fuel cell stack containing at least one fuel cell for obtaining a resultant and heat, is the pressurized first reagin feed zone and has a pressure control valve for adjusting the pressure of said first reagin feed zone further, In the power plant which changes including the pressurized second reagin feed zone, it is the approach of carrying out recycling of the first reagin style. Process which inserts the vacuum ejector containing the inlet port for (a) promotion, inhalation opening, and an exhaust port between said first reagin feed zones and inlet ports of said first reagin style;

(b) Process connected so that said first reagin feed zone and fluid may pass along said inlet port for promotion;

(c) Process connected so that the outlet and fluid of said first reagin style may pass along said inhalation opening;

(d) Process connected so that the inlet port and fluid of said first reagin style may pass along said exhaust port;

(e) Process which inserts the pressure transducer which can transmit the signal which detects the pressure of said first reagin style and corresponds to said pressure control valve between said exhaust ports and said inhalation openings;

(f) process; which a signal is transmitted [;] to said pressure control valve, and raises the supply pressure of said first reagin when the detection pressure of said first reagin style is less than a predetermined value -- and -- (g) -- said approach including the process at which a signal is transmitted to said pressure control valve, and the supply pressure of said first reagin is reduced when the detection pressure of said first reagin style exceeds a predetermined value.

25. The approach according to claim 24 said second reagin style contains [said first reagin style] oxygen, including hydrogen.

26.(h) Process which inserts the second reagin pressure transducer which can transmit the signal which detects the pressure of said second reagin style and corresponds to said pressure control valve between the inlet port of said second reagin style, and said second reagin feed zone;

(i) -- process; which a signal is transmitted [;] to said pressure control valve, and raises the supply pressure of said first reagin when the detection pressure of said second reagin style rises -- and -- (j) -- the approach according to claim 24 of including further the process at which a signal is transmitted to said pressure control valve, and the supply pressure of said first reagin is reduced when the detection pressure of said second reagin style falls.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
Field of electrochemical fuel cell equipment invention possessing the vacuum ejector with which it was adjusted for carrying out recycling of the flow of a fuel fluid This invention relates to an electrochemical fuel cell. This invention relates to the power generator containing a fuel cell stack and the vacuum ejector with which it was adjusted for carrying out recycling of the flow of a fuel fluid more at a detail. This equipment maintains the rate of a recycle ratio of a fuel uniformly, and maintains the balance between fuel fluid pressure and oxidizing agent fluid pressure.
Background of invention An electrochemical fuel cell changes a fuel and an oxidizer into the electrical and electric equipment and a resultant. As for a solid-state polymer electrochemical fuel cell, it is common to use the membrane electrode collection object "MEA" with which ion exchange membrane or a solid-state polymer electrolyte is arranged inter-electrode [which was made with the porosity conductive liner sheet ingredient (typically carbon fiber paper) / of two sheets], and changes. MEA contains the catalyst bed which is fines-like platinum typically in the field side of the film/electrode in order to make desired electrochemical reaction induce. These electrodes are connected electrically and the path for leading an inter-electrode electron to an external load is offered.
In an anode, a cation generates at a fuel penetrating a porous electrode ingredient and reacting by the catalyst bed, and this moves even a cathode through the film. In a cathode, the supplied oxygenated gas reacts by the catalyst bed, and an anion generates. The anion generated with this cathode reacts with a cation, and a resultant is acquired.
In the case of the electrochemical fuel cell which uses hydrogen as a fuel and uses oxygenated air (or substantially pure oxygen) as an oxidizer, with an anode, a hydrogen cation (proton) generates from a supply fuel by catalytic reaction. The migration of a hydrogen ion to a cathode from an anode is promoted by ion exchange membrane. This film besides the flow of a hydrogen ion separates the flow of a hydrogen-containing fuel, and the flow of an oxygenated fuel. In a cathode, oxygen reacts by the catalyst bed and an anion generates. The anion generated with the cathode reacts with the hydrogen ion which has crossed this film, and water liquefied as the resultant generates it.
The reaction of the anode in the fuel cell of hydrogen / oxygen system and a cathode is as follows. Anode reaction: H2 ->2H++2e- Cathode reaction: 1/2 O2+2H++2e-->H2O In the typical fuel cell, MEA is arranged between two electric conduction plates with which at least one passage is engraved in the interior, respectively. The electric conduction plate used as the place where these fluids flow has the typical case of being made of graphite. A fuel and an oxidizer are oriented with a cathode by such passage by the anode and the oxidizer side at each electrode, i.e., fuel, side. In the case of the size D battery type, the electric conduction plate used as the place where a fluid flows is formed in each by the side of an anode and a cathode. The electric conduction plate used as the place where this fluid flows acts as a charge collector, serves as a base material for an electrode, serves as access passage which leads a fuel and an oxidizer to the front face of an anode and a cathode, respectively, and becomes the passage for removing the water generated during cell operation.
Generally two or more fuel cells are mutually connected to juxtaposition at a serial depending on the case, and the whole collection object output can be increased. In serial arrangement, one side of a certain electric conduction plate used as the place where a fluid flows acts as an anode plate by a certain cell, and the opposite side of the electric conduction plate used as the place where the fluid

flows can act as a cathode plate of an adjoining cell. Arrangement of two or more fuel cells connected to such a serial is called a fuel cell stack, and it is held together by the tension bolt and the end plate in the condition of usually having been collected. As for a stack, it is typical to include the manifold and inlet port for orienting the flow (substantially pure hydrogen, a methanol-reforming object, or a natural gas reforming object) of a fuel fluid and the flow (substantially pure oxygen or oxygenated air) of a fuel oxidizer with the passage used as the flow field of an anode and a cathode. As for the stack, it is common to include the manifold and inlet port for orienting the flow of a refrigerant fluid (typically water) with the internal passage inside a stack in order to absorb the heat generated by the exothermic reaction of the hydrogen and oxygen inside a fuel cell again. As for a stack, it is still more common to include the discharge manifold and outlet for the refrigerant which comes out from a stack in the discharge manifold for driving out the unreacted fuel and oxidant gas accompanied by taking of water, respectively and an outlet, and a list.
Generally, a solid-state polymer fuel cell is [perfluoro-sulfonic-acid system ion exchange membrane, for example, the thing marketed by the trade name of NAFION from DuPont, and] Dow. What is marketed by the trade name of XUS 13204.10 from the shrine is used. While promoting cation exchange by introducing to a solid-state polymer fuel cell after humidifying the flow of the reagin of a fuel and an oxidizer, respectively when using such film, it is common to prevent desiccation of the ion exchange membrane which has separated the anode and cathode of each cell, as a result damage.
To each fuel cell which constitutes the stack, it is typical that a specific fuel and a specific oxidizer are poured so much by the desired pressure. Generally this pressure is controlled by the controller in the source of reagin. If electrical load is covered over the circuit which has connected the electrode, a fuel and an oxidizer will be consumed in proportion [directly] to the current pulled out with the load.
Generally the flow of each reagin which comes out from a fuel cell stack contains water. As for the outlet fuel style of the anode origin, it is common to contain the water added in order to humidify the water and the fuel style of all products which crossed the film, were pulled out from the cathode and absorbed as a steam in the fuel style. As for the outlet oxidizer style of the cathode origin, it is common to contain the water added in order to humidify the water and the oxidizer style of a product which were generated with the cathode which is taken as waterdrop or is absorbed as a steam in an oxidizer style. In order to maintain so that water may be removed and the passage in a stack may not be taken up with increase of the output of a fuel cell stack, since the moisture accumulated in an anode and a cathode increases, the recycling rate of flow must be made high.
The superfluous moisture extracted from both reagin both [one side or] which come out from a fuel cell can be accumulated in an eliminator or a protrusion drum. Thus, recycling of the accumulated superfluous moisture may be carried out after that, and it may be used as the source of a refrigerant fluid or the moisture for humidification, or may only be discharged from equipment.
In being pure hydrogen or oxygen substantially [the reagin supplied to a fuel cell / one], in order to press down the trash produced since reagin is exhausted in atmospheric air to the minimum, recycling of the non-consumed reagin discharged from a fuel cell may be carried out. The reagin style which carries out recycling may be made to join in a new corresponding reagin installation style and the upstream of the inlet port to a fuel cell stack after removing the superfluous moisture. By making the reagin style which carries out recycling join a new reagin installation style and directly as an exception method, while the steam had been made to contain, the new reagin installation style can be humidified and the independent humidifier can also be made unnecessary. Similarly, when both both [one side or] are thin reagins like a reforming object or air, especially in the case of a fuel style, recycling of the non-consumed reagin discharged from a fuel cell can be carried out. However, when it is air, especially a thin reagin style is discarded in many cases, once passing a fuel cell stack. As for the superfluous moisture in the outlet of a thin reagin style, being removed in an eliminator or a protrusion drum is common. Then, as for a reagin exhaust stream, being emitted into atmospheric air is common.
by making the water of the product separated from the outlet of a reagin style coalesce in a refrigerant style, it carries out [it is alike occasionally and] and is advantageous to adjust the temperature of a stack using the water of the product electrochemically produced in the fuel cell

stack. When the water of a product is used as a refrigerant, it becomes unnecessary to prepare the source of a refrigerant fluid independently outside in this point. It is because the water generated with a fuel cell serves as a refrigerant fluid with suitable itself.
When the equipment which uses it, making carry out recycling of the reagin style is characterized, it is convenient if you define the vocabulary "a recycle ratio." A "recycle ratio" means the ratio obtained by carrying out division process of the reagin amount of supply to a fuel cell stack with the reagin consumption at the time of passing a fuel cell stack once among this specification. the case of typical hydrogen / oxygen system fuel cell stack -- the recycle ratio of hydrogen -- 1.2-5.0 -- it is in the range of 1.5-2.0 more preferably.
In order to perform recycling, the vacuum ejector (vacuum ejector) is used for the fuel cell system power plant to which recycling of 1 or the two or more reagin styles is carried out. Winters A U.S. Pat. No. 3,462,308 specification is made to carry out recycling of each of the fuel style discharged from the fuel cell, and an oxidizer style by the ejector 23 and 23', and the fuel cell equipment made to join each fuel style and oxidizer style which are newly introduced is indicated.
Each ejector is indicated as a thing containing a venturi throat. However, Winters The ejector configuration is designed for [which needs the pressure drawdown of a fixed reagin style for passage of each ejector] fixed-point operation. It is Winters in order to maintain pressure drawdown required for passage of an ejector. Equipment discards a recycling reagin style through a bleed valve 21 and 21' if needed. Thus, Winters Although reagin recycling equipment shows load flattery ability (load-following capability), it causes the disadvantage on the serious effectiveness by exhaust air into the atmospheric air of a recycling reagin style.
The vacuum ejector is introduced also into the fuel processing second-order system of a reforming object system fuel cell generation-of-electrical-energy system again. Fanciullo ** -- on the U.S. Pat. No. 3,745,047 specifications, after drawing flow in the style of a fuel using an ejector, it is introduced to the reforming machine. however, Fanciullo ** -- in a system, an ejector is not used for recycling of a fuel style (or oxidizing agent style) This is because recycling of the fuel style of an outlet is not carried out to a fuel cell, instead it is turned to the burner of a reforming machine through a conduit 34.
The key objective of an ejector is to transport a gas, a liquid, fine particles, or a solid particulate to comparatively high pressure level from a certain pressure level. Generally so, it is considered excluding a propulsion section that an ejector is a passive device. Within an ejector, in that case, the pressurized drag flow object passes a nozzle, when a fluid comes out of the regio oralis of a nozzle, a pressure dissipates, and a fluid is accelerated. The flow of the fluid of the high speed which leaves this nozzle takes the comparatively low-pressure fluid introduced into the ejector with inhalation opening. By a low-pressure suction fluid being taken with a drag flow object, a suction fluid moves with a drag flow object. These two sorts of flow is mixed in case the diffuser circles of an ejector are passed. The velocity profile of flow changes along the passage of an ejector, and if, as for the pressure of flow, a fluid arrives at the outlet of an ejector, it will go up. Since the pressure drawdown width of face which crosses the nozzle of an ejector increases as the rate of flow of a drag flow object goes up, in order to maintain exhaust pressure uniformly, it is necessary to also raise driving pressure. The rate of flow of a suction fluid also goes up with the rise of promotion / exhaust pressure force.
Outline of invention It sets like 1 operative condition and is this invention. Fuel cell stack which changes including at least one fuel cell for promoting the electrocatalysis reaction of the fuel style introduced from the inlet port of (a) fuel style, the outlet of a fuel style, the inlet port of an oxidizer style, and the inlet port of this fuel style, and the oxidizer style introduced from the inlet port of this oxidizer style, and obtaining the electrical and electric equipment, a resultant, and heat;
(b) Pressurized fuel feed zone which has a pressure control valve for adjusting a fuel supply pressure;
(c) It is the vacuum ejector connected by connecting so that it is the vacuum ejector inserted between this fuel feed zone and the inlet port of this fuel style, it may connect so that a fluid may pass along this inlet port for promotion, and this fuel feed zone including the inlet port for promotion, inhalation opening, and an exhaust port, and a fluid may pass along this inhalation opening and the outlet of this fuel style so that a fluid may pass along this exhaust port and the inlet port of this fuel style.;

(d) pressure-transducer; which is the pressure transducer inserted between this exhaust port and this inhalation opening in this fuel style, and transmits the signal which detects the pressure of this fuel style and corresponds to this pressure control valve -- and -- The power plant which changes including the pressurized oxidizer feed zone which is connected so that the inlet port and fluid of (e) this oxidizer style may pass is included.
When a pressure transducer detects the fall which is less than the predetermined value of the pressure of a fuel style which will happen if a load increases and the ejector passage rate of flow of a fuel style goes up as a result at the time of operation, the signal which raises a fuel supply pressure is transmitted to a pressure control valve. On the contrary, loads decrease in number, and a pressure transducer transmits the signal to which a fuel supply pressure is reduced to a pressure control valve, when the rise exceeding the predetermined value of the pressure of a fuel style which will happen if the ejector passage rate of flow of a fuel style falls as a result is detected.
In a desirable power plant, a fuel cell stack includes the outlet of an oxidizer style further. As for a pressure transducer, in a fuel style, it is desirable to be inserted between said exhaust ports and inlet ports of a fuel style.
The signal transmitted by the pressure transducer can be electric or mechanical so that the electrical signal, fluid pressure signal, or air pressure signal equivalent to the detection pressure of a fuel style may be transmitted to a pressure control valve.
With desirable equipment, the pressurized supply fuel contains pure hydrogen substantially. As for the pressurized supply oxidizer, it is desirable that oxygen is included. A desirable supply oxidizer is oxygenated air. When a fuel is hydrogen and an oxidizer is oxygen, the resultant serves as water.
In each of a fuel cell, with desirable equipment, this equipment contains the oxidizer style humidifier for giving a steam the fuel style humidifier and oxidizer style for giving a steam in the style of a fuel further, including ion exchange membrane. It is desirable to remove a part of moisture [at least] which inserts a water separator between a fuel tap hole and inhalation opening, and is contained in a fuel style.
With the most desirable equipment, an oxidizer feed zone has a pressure transducer for transmitting the signal which detects the pressure of an oxidizer style and corresponds to a pressure control valve so that the signal to which a fuel supply pressure is reduced may be transmitted to a pressure control valve, when the signal which raises a fuel supply pressure is transmitted to a pressure control valve when the pressure buildup of an oxidizer style is detected, and the pressure drop of an oxidizer style is detected.
At another embodiment, it is this invention. Fuel cell stack which changes including at least one fuel cell for promoting the electrocatalysis reaction of the fuel style introduced from the inlet port of (a) fuel style, the inlet port of an oxidizer style, the outlet of an oxidizer style, and the inlet port of this fuel style, and the oxidizer style introduced from the inlet port of this oxidizer style, and obtaining the electrical and electric equipment, a resultant, and heat;
(b) Pressurized oxidizer feed zone which has a pressure control valve for adjusting an oxidizer supply pressure;
(c) It is the vacuum ejector connected by connecting so that it is the vacuum ejector inserted between this oxidizing agent feed zone and the inlet port of this oxidizing agent style, it may connect so that a fluid may pass along this inlet port for promotion, and this oxidizing agent feed zone including the inlet port for promotion, inhalation opening, and an exhaust port, and a fluid may pass along this inhalation opening and the outlet of this oxidizing agent style so that a fluid may pass along this exhaust port and the inlet port of this oxidizing agent style.;
(d) pressure-transducer; which is the pressure transducer inserted between this exhaust port and this inhalation opening in this oxidizer style, and transmits the signal which detects the pressure of this oxidizer style and corresponds to this pressure control valve -- and -- The power plant which changes including the pressurized fuel feed zone which is connected so that the inlet port and fluid of (e) this fuel style may pass is included.
When the fall in which a pressure transducer is less than the predetermined value of the pressure of an oxidizer style at the time of operation is detected, the signal which raises an oxidizer supply pressure is transmitted to a pressure control valve. On the contrary, a pressure transducer transmits the signal to which an oxidizer supply pressure is reduced to a pressure control valve, when the rise

exceeding the predetermined value of the pressure of an oxidizer style is detected.
In a desirable power plant, a fuel cell stack includes the outlet of a fuel style further. As for a pressure transducer, in an oxidizer style, it is desirable to be inserted between said exhaust ports and inlet ports of an oxidizer style. As for the pressurized supply oxidizer, it is desirable that pure oxygen is included substantially.
With the most desirable equipment, a fuel feed zone has a pressure transducer for transmitting the signal which detects the pressure of a fuel style and corresponds to a pressure control valve so that the signal to which an oxidizer supply pressure is reduced may be transmitted to a pressure control valve, when the signal which raises an oxidizer supply pressure is transmitted to a pressure control valve when the pressure buildup of a fuel style is detected, and the pressure drop of a fuel style is detected.
In the another embodiment, this inventions are a fuel cell stack and the first pressurized reagin feed zone, and include the approach of carrying out recycling of the first reagin style in the power plant containing what has a pressure control valve for adjusting the pressure of this reagin feed zone, and the second pressurized reagin feed zone. This approach includes the following processes.
(a) Process which inserts the vacuum ejector containing the inlet port for promotion, inhalation opening, and an exhaust port between the first reagin feed zone and the inlet port of the first reagin style of a stack;
(b) Process connected so that the reagin feed zone and fluid of this first may pass along this inlet port for promotion;
(c) Process connected so that the first outlet and fluid of a reagin style of this stack may pass along this inhalation opening;
(d) Process connected so that the first inlet port and fluid of a reagin style may pass along this exhaust port;
(e) this -- the pressure transducer which can transmit the signal which detects the pressure of the first reagin style and corresponds to this pressure control valve -- this exhaust port -- this -- process; inserted between the inlet ports of the first reagin style
(f) this -- process; which transmits the signal which raises the supply pressure of this first reagin from a pressure transducer to a pressure control valve when the fall which is less than the predetermined value of the pressure of the first reagin style is detected -- and -- (g) -- this -- process which transmits the signal to which the supply pressure of this first reagin is reduced from a pressure transducer to a pressure control valve when the rise exceeding the predetermined value of the pressure of the first reagin style is detected.
a desirable approach -- this -- the first reagin style -- hydrogen -- containing -- and -- this -- the second reagin style contains oxygen.
The most desirable approach includes the following processes further.
(h) this -- process; which inserts the second reagin pressure transducer which can transmit the signal which detects the pressure of the second reagin style and corresponds to this pressure control valve between the inlet port of the second reagin style of this stack, and the second reagin feed zone
(i) -- this -- process; which transmits the signal which raises the supply pressure of this first reagin from a pressure transducer to a pressure control valve when the rise of the pressure of the second reagin style is detected -- and -- (j) -- this -- process which transmits the signal to which the supply pressure of this first reagin is reduced to a pressure control valve when the fall of the pressure of the second reagin style is detected.
Easy explanation of a drawing Fig. 1 is a schematic diagram of one embodiment of the fuel cell system power plant possessing the vacuum ejector with which it was adjusted for recycling of fluid fuel flow.
Fig. 2 is a cross-sectional view of the vacuum ejector illustrated roughly in Fig. 1.
Detailed explanation of a desirable embodiment First, although Fig. 1 is referred to, the fuel cell system power plant 10 contains the fuel cell stack 100 and the thing containing two or more desirable fuel cells. this fuel cell stack 100 -- Watkins ** -- it is indicated by the detail with the U.S. Pat. No. 5,200,278 specification (drawing 1 -6 and attached text), and that whole is used by referring to this on these specifications. supply and the control system of the desirable reagin for the fuel cell of the type which constitutes a stack 100 -- Merritt ** -- it is indicated by the U.S. Pat. No. 5,366,821

specification, and the whole is used by referring to this on these specifications.
Each has an anode, a cathode, an electrolyte (preferably solid-state polymer ion exchange membrane), and cooling/humidification unit so that the fuel cell of a stack 100 may be explained to a detail below. As roughly illustrated to Fig. 1, the fuel cell stack 100 includes the inlet port 110 of a fuel style, the outlet 112 of a fuel style, the inlet port 114 of an oxidizer style, the outlet 116 of an oxidizer style, the inlet port 118 of a refrigerant / humidification fluid, and the outlet 119 of a refrigerant / humidification fluid.
The circuit where the fuel cell stack 100 includes the adjustable load 106 and the contact switch 108 in these including a negative and forward bus-bar plate (102 respectively 104) is connected electrically. Equipment 10 includes the fuel circuit, oxidizer circuit, and cooling/humidification circuit other than a stack 100.
The fuel circuit of the equipment 10 of Fig. 1 contains the pure hydrogen feed zone 120 in the pressurized real target which has the fuel supply line 136. The pressure control valve 122 which can receive a signal and can answer this adjusts the pressure of the fuel style from a supply line 136 so that it may illustrate and may explain to a detail below. The vacuum ejector 124 is inserted between the fuel feed zone 120 and the inlet port 110 of the fuel style of a stack 100.
An ejector 124 contains the inlet port 126 for promotion, the inhalation opening 128, and an exhaust port 130. It connects so that a fluid may pass to the outlet of a pressure control valve 122, and the inlet port 126 for promotion receives the pressurized fuel style 136, as illustrated. The inhalation opening 128 is connected so that a fluid may pass to the outlet 112 of the fuel style of a stack 100, and recycling of the discharge fuel style 142 is carried out. Between the outlet 112 of the fuel style of a stack 100, and the inhalation opening 128 of an ejector 124, the water separator or the protrusion drum 144 is inserted. Before a water separator 144 flows to the inhalation opening 128 of an ejector 124 and turns 146, it removes a part of moisture [at least] contained in the style of [142] a discharge fuel. Thus, the introductory fuel style 140 is formed with coalesce with the fuel style 146 by which recycling was carried out, and the new pressurization fuel style 138.
The exhaust port 130 of an ejector 124 is connected so that a fluid may pass at the inlet port 110 of the fuel style of a stack 100. The pressure transducer 132 is inserted between the exhaust port 130 and the inlet port 110 of a fuel style. A pressure transducer 132 can detect the pressure of the introductory fuel style 140, and can transmit the signal corresponding to the pressure detected in the introductory fuel style 140. The signal from a pressure transducer 132 to a pressure control valve 122

Although the broken line showed ** and Fig. 1, it may be an electric signal or you may be a mechanical signal. At this point, the electrical signal corresponding to detection pressure, fluid pressure signal, or air pressure signal of an introductory fuel style is transmitted to a pressure control valve 122 from a pressure transducer 132. The detection pressure of the introductory fuel style 140 is abbreviation 1.38x105-3 in a predetermined value and a type target during operation.
In the gage pressure of 45x105Pa (20 - 50 psi), and nominal rating, when less than the gage pressure of about 2.07x105Pa (30 psi), a pressure transducer 132 transmits a signal to a pressure control valve 122 so that the pressure of the fuel style 138 may be heightened. The detection pressure of the introductory fuel style 140 will be less than the predetermined value, when a load increases and the ejector passage rate of flow of a fuel style goes up as a result. On the contrary, when the detection pressure of the introductory fuel style 140 exceeds a predetermined value, a pressure transducer 132 transmits a signal to a pressure control valve 122 so that the pressure of the fuel style 138 may be lowered. The detection pressure of the introductory fuel style 140 will exceed the predetermined value, when loads decrease in number and the ejector passage rate of flow of a fuel style falls as a result. While being able to make an ejector 124 into load flattery nature, therefore being able to maintain comparatively uniformly the pressure of the introductory fuel style to a fuel cell stack over a series of potential service conditions by the interaction of a pressure transducer 132 and a pressure control valve 122, the recycle ratio of a discharge fuel style can be maintained comparatively uniformly.
The oxidizer circuit of the equipment 10 in Fig. 1 contains the pressurized oxygenated air supply section 150 as a source of the introductory oxidizer style 152. The pressure transducer 156 is inserted between the oxidizer feed zone 150 and the inlet port 114 of an oxidizer style. A pressure transducer

156 can detect the pressure of the introductory oxidizer style 152, and can transmit the signal corresponding to the pressure detected in the introductory oxidizer style 152. Although the broken line showed the signal from a pressure transducer 156 to a pressure control valve 122 in Fig. 1, it may be an electric signal or may be a mechanical signal. At this point, the electrical signal corresponding to detection pressure, fluid pressure signal, or air pressure signal of an introductory fuel style is transmitted to a pressure control valve 122 from a pressure transducer 156. During operation, when the detection pressure of the introductory oxidizer style 152 rises, a pressure transducer 156 transmits a signal to a pressure control valve 122 so that the pressure of the fuel style 138 may be heightened.

On the contrary, when the detection pressure of the introductory oxidizer style 152 falls, a pressure transducer 156 transmits a signal to a pressure control valve 122 so that the pressure of the fuel style 138 may be lowered. Thus, a pressure transducer 156 acts as bias to a pressure control valve 122 so that the balance between the pressure of the introductory fuel style 140 and the pressure of the introductory oxidizing agent style 152 may be maintained.

The discharge oxidizer style 154 is discharged from a stack 100 through the outlet 116 of an oxidizer style. A water separator or the protrusion drum 156 removes a part of moisture [at least] contained in the style of [154] a discharge oxidizer. As illustrated to Fig. 1, the discharge oxidizer style 158 from a water separator 156 is discharged from equipment 10 to atmospheric air.

Cooling/humidification circuit of the equipment 10 in the 1st Fig. contains ** 162. ** 162 can receive the water removed from the discharge fuel style and the discharge oxidizer style from water separators 144 and 156. The flow 164 of the refrigerant / humidification fluid from ** 162 is sent into the inlet port 118 of the refrigerant / humidification fluid of a stack 100 as pressurized flow 168 with a pump 166.

The flow 170 of a discharge refrigerant / humidification fluid is discharged from a stack 100 through the outlet 119 of a refrigerant / humidification fluid. Then, as illustrated to Fig. 1, the flow 170 of a discharge refrigerant / humidification fluid is returned to ** 162.

Fig. 2 is a cross-sectional view of the vacuum ejector 124 illustrated roughly in Fig. 1. The vacuum ejector 124 contains the inlet port 126 for promotion, the inhalation opening 128, and an exhaust port 130. An ejector 124 contains a propelling nozzle 202, the promotion chest 204, the diffuser section 206, the introductory diffuser 208, the diffuser throat 210, and the discharge diffuser 212 further.

Furthermore, in order to carry out recycling of the flow of a fluid oxidizer, it is also possible to introduce a vacuum ejector into the fuel cell system power plant which uses pure oxygen substantially as an oxidizer style. Probably, at this point, the principle mentioned above about recycling by the vacuum ejector of the flow of a fluid fuel and the same principle as an essential target are applied to recycling by the vacuum ejector of the flow of a fluid oxidizing agent.

Although the specific element of this invention, an embodiment, and application have been shown and explained, it will be understood that limitation is not carried out to these, but it can especially be changed by the above-mentioned instruction if this invention is this contractor. Therefore, an attached claim means as a thing including the description included in such modification at the pneuma of this invention, and within the limits.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

[Drawing 1]

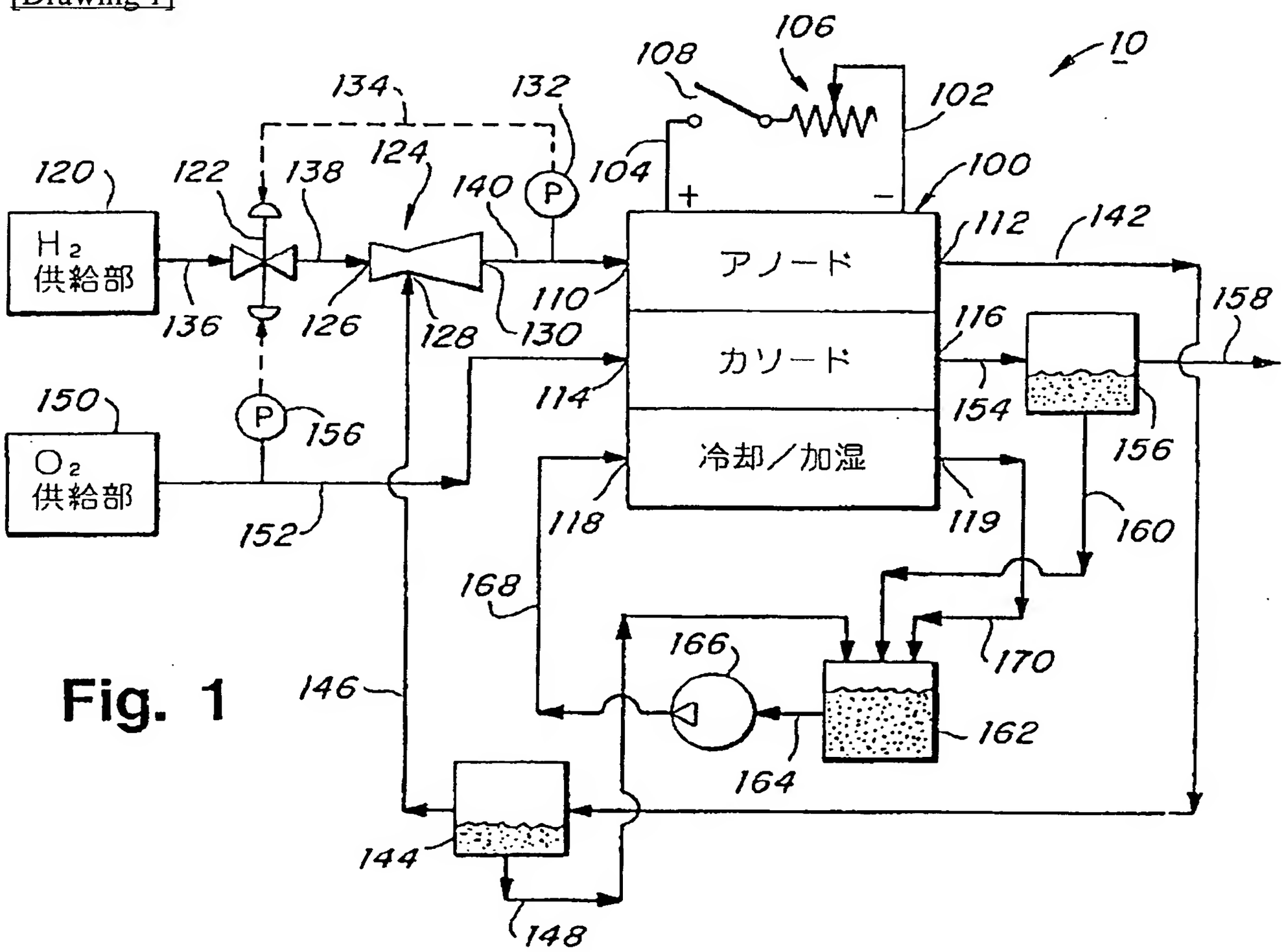

Fig. 1

[Drawing 2]

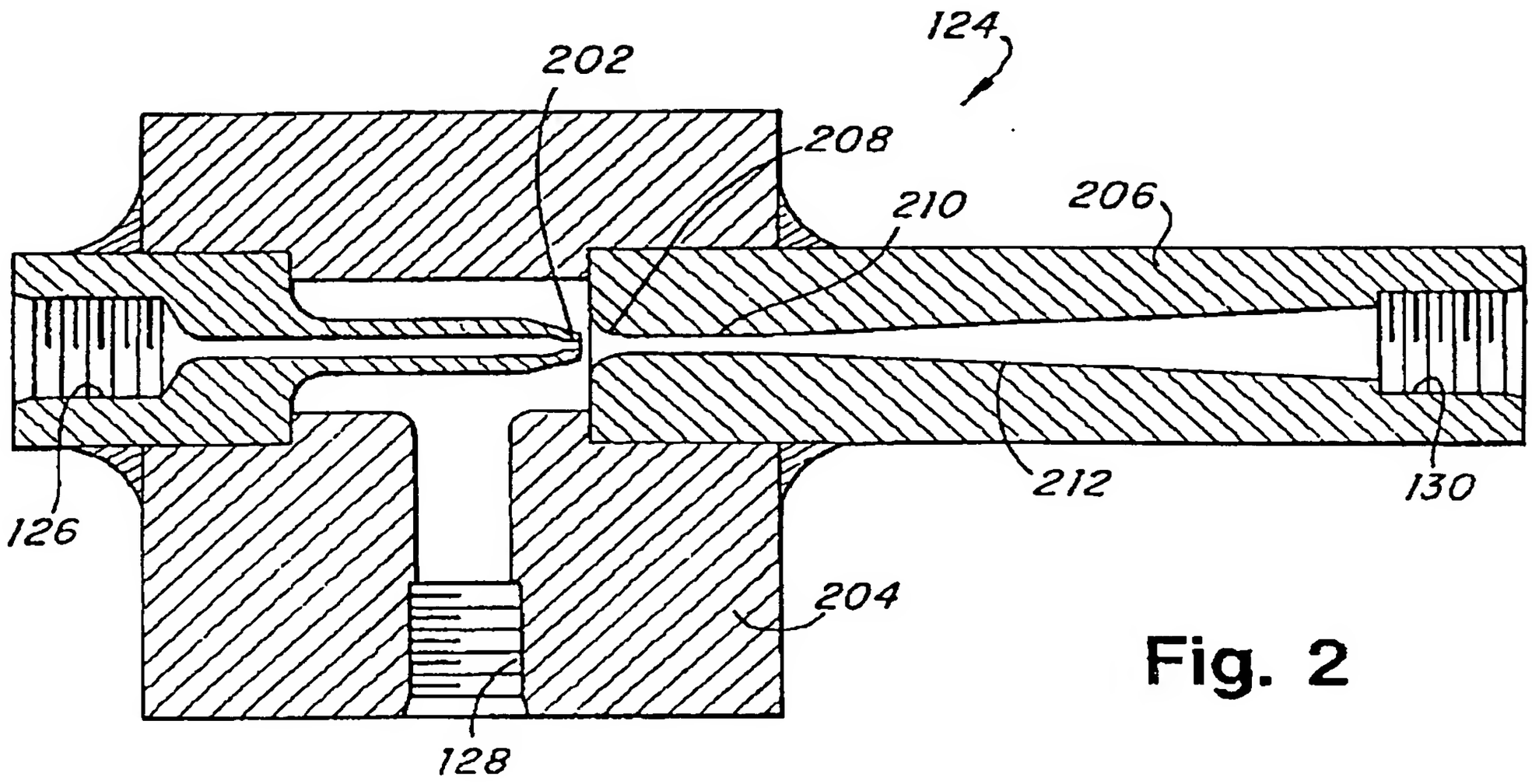

Fig. 2

[Translation done.]

* NOTICES *

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WRITTEN AMENDMENT

[Procedure revision] The 8 1st term of Article 184 of Patent Law
[Filing Date] December 10, 1996
[Proposed Amendment]
CLAIMS
1.(a) Inlet port of first reagin style, outlet of first reagin style, and close [of the second reagin style]
The first reagin style introduced at opening and the inlet port of said first reagin style, and said second reagin style
An electrocatalysis reaction with the second reagin style introduced at the entrance is promoted, and they are the electrical and electric equipment and **********.
Fuel cell stack which changes including at least one fuel cell for obtaining ****;
(b) The pressurized first which has a pressure control valve for adjusting the first reagin supply pressure
Reagin feed zone;
(c) Truth inserted between said first reagin feed zones and inlet ports of said first reagin style
It is an empty ejector, the inlet port for promotion, inhalation opening, and an exhaust port are included, and it is said promotion.
business -- an inlet port and said first reagin feed zone are connected so that a fluid may pass -- having -- **** -- said inhalation
It connects so that a fluid may pass, and opening and the outlet of said first reagin style are described above.
An exhaust port and the inlet port of said first reagin style are vacuum IJI connected so that a fluid may pass.
EKUTA;
(d) In said first reagin style, it was inserted between said exhaust ports and said inhalation openings.
It is a front about the signal which is the first pressure transducer, detects the pressure of said first reagin style and corresponds.
The first pressure transducer transmitted to an account pressure control valve;
(e) it connects so that the inlet port and fluid of said second reagin style may pass -- it was pressurized
The second reagin feed zone; it reaches.
(f) ** inserted between said second reagin feed zones and inlet ports of said second reagin style
It is two pressure transducers and the signal which detects the pressure of said second reagin style and corresponds is described above.
The second pressure transducer transmitted to a pressure control valve
It is the power plant which changes by ******,
When said first pressure transducer is less than a value predetermined in the detection pressure of said first reagin style
****** is transmitted to said pressure control valve, and said first reagin supply pressure is raised, and it is a front.
The first pressure transducer of an account is ****** when the detection pressure of said first reagin style exceeds a predetermined value.
a number is transmitted to said pressure control valve, and said first reagin supply pressure is fallen -

- making -- and
Said second pressure transducer is a front about a signal, when the detection pressure of said second reagin style rises.
It transmits to an account pressure control valve, and said first reagin supply pressure is raised, and it is said second pressure.
A converter is said pressure control valve about a signal, when the detection pressure of said second reagin style falls.
The power plant to which it transmits and said first reagin supply pressure is reduced.
2. It is Account to Claim 1 in which Said Fuel Cell Stack Includes Outlet of Second Reagin Style Further.
The power plant of **.
3. Said First Pressure Transducer Sets in the style of [Said] First Reagin, and is Said Exhaust Port and Said **.
The power plant according to claim 1 inserted between the inlet ports of a 1 reagin style.
4. Electrical Signal with Which Said First Pressure Transducer is Equivalent to Detection Pressure of Said First Reagin Style
The power plant according to claim 1 transmitted to said pressure control valve.
5. Fluid Pressure Signal with Which Said First Pressure Transducer is Equivalent to Detection Pressure of Said First Reagin Style
The power plant according to claim 1 transmitted to said pressure control valve.
6. Air Pressure Signal with Which Said First Pressure Transducer is Equivalent to Detection Pressure of Said First Reagin Style
The power plant according to claim 1 transmitted to the aforementioned pressure control valve.
7. Claim Said whose First Reagin is Fuel and Said whose Second Reagin is Oxidizer
A power plant given in 1.
8. Claim 7 in which Said Pressurized First Reagin Feed Zone Contains Pure Hydrogen Substantially
It is alike and is the power plant of a publication.
9. Said Pressurized Second Reagin Feed Zone Contains Oxygen, and Said Resultant is with Water.
A certain power plant according to claim 8.
10. The power plant according to claim 9 said whose second reagin feed zone is oxygenated air.
11. At Least One of Said the Fuel Cells Contains Ion Exchange Membrane, and it is Said Equipment.

Furthermore, the first reagin style humidifier for giving a steam in the style of [said] the first reagin and before
Claim 1 containing the second reagin style humidifier for giving a steam in the style of the second reagin of an account
It is alike and is the power plant of a publication.
12. between Outlet of Said First Reagin Style, and Said Inhalation Openings -- Water Separator -- Inserting -- Therefore
It is an account to claim 11 which removes a part of moisture [at least] contained in said first reagin style.
The power plant of **.
13. Inlet Port of First Reagin Style, Outlet of First Reagin Style, and Inlet Port of Second Reagin Style,
Close [of said first reagin style introduced at the inlet port of said first reagin style, and said second reagin style]
An electrocatalysis reaction with said second reagin style introduced by the mouth is promoted, and they are the electrical and electric equipment and a resultant.
And it is **** about the fuel cell stack containing at least one fuel cell for obtaining heat.
It is the first reagin feed zone which came out, changed and was pressurized further, and is said first reagin feed zone.
The second reagin supply pressurized with what has a pressure control valve for adjusting ******
In the power plant which changes including the section, it is the approach of carrying out recycling of the first reagin style.

**
(a) It is said ** about the vacuum ejector containing the inlet port for promotion, inhalation opening, and an exhaust port.
Process inserted between a 1 reagin feed zone and the inlet port of said first reagin style;
(b) It is connection ****** so that said first reagin feed zone and fluid may pass along said inlet port for promotion.
Degree;
(c) The process connected so that the outlet and fluid of said first reagin style may pass along said inhalation opening
;
(d) The process connected so that the inlet port and fluid of said first reagin style may pass along said exhaust port
;
(e) He is an intermediary to said pressure control valve about the signal which detects the pressure of said first reagin style and corresponds.
About the first pressure transducer which can **, it is ****** between said exhaust ports and said inhalation openings.
******;
(f) When the detection pressure of said first reagin style is less than a predetermined value, it is said pressure about a signal.
Process which it transmits [process] to a control valve and raises the supply pressure of said first reagin;
(g) When the detection pressure of said first reagin style exceeds a predetermined value, it is said pressure about a signal.
The process at which it transmits to a control valve and the supply pressure of said first reagin is reduced
(h) He is an intermediary to said pressure control valve about the signal which detects the pressure of said second reagin style and corresponds.
About the second pressure transducer which can **, it is the inlet port and said second reaction of said second reagin style.
Process inserted between body feed zones;
(i) When the detection pressure of said second reagin style rises, he is an intermediary to said pressure control valve about a signal.
The process which it ** [process] and raises the supply pressure of said first reagin; it reaches.
(j) When the detection pressure of said second reagin style falls, he is an intermediary to said pressure control valve about a signal.
The process at which it ** and the supply pressure of said first reagin is reduced
The ****** aforementioned approach.
14. Said Second Reagin Style Contains [Said First Reagin Style] Oxygen, Including Hydrogen, An approach according to claim 13.

[Translation done.]